THE IRON TRADE REVIEW

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MORE INTEREST

SHOWN BY PIG IRON BUYERS IN FUTURE DELIVERIES

And Other Signs of Improvement Are Noticeable.—Heavy Reduction in Blast Furnace Output.—Great Record of Lake Ore Shipments.

Indications of improvement in the iron and steel markets are easily discernable in spite of the fact that pig iron prices are still sagging and that the rapid curtailment of production of coke, pig iron and finished materials still continues. There is not the same strain in financial affairs; collections are slightly better; suspensions of delivery on contracts are not so numerous; some suspensions have been released, and there is a noticeable increase in interest in the pig iron market.

Wage Reductions

While a few steel plants have resumed operations, others have become idle, and the active capacity does not differ materially from that of a week ago. It is estimated that 65 per cent of the steel mill capacity of the Carnegie Steel Co. is now idle. Wage readjustments are being carried on, and in many cases the reductions are equal to the advances made during the past two years. A sharp reduction in the wages of employes in the coke region will be made this week.

Tin Plate Improves

A decided improvement is noticeable in the tin plate business. The leading interest has taken on considerable new business and specifications are coming in freely. One important independent manufacturer of tin plate has resumed after the plant had been idle for several weeks. Business in sheets is not active, although some orders for immediate shipment are being received.

Hints From Railroads

The rail situation shows no change so far as actual orders are concerned, but hints of railroad interests that reservations for large tonnages may soon be made are coming with increasing frequency. The buying of railroad interests has caused a better feeling in the New York machinery market.

Inquiry for Pig Iron

An increasing number of inquiries for southern pig iron for future delivery is noticeable in spite of the sagging tendency of the market. Although $15 Birmingham is the usual quotation, iron can be bought 50 cents lower. A large manufacturer of agricultural implements is figuring on about 7,500 tons, and several other inquiries of from 1,000 to 2,500 tons are pending. Some inquiries of fair size are also pending for northern iron, but in northern market centers as well as in southern very few actual transactions are being made. Bessemer iron is quoted nominally at $19 valley. But this could probably be shaded. At least one sale of a fair tonnage in basic has been made at about $17.50 valley furnace.

Structural Material

In structural material the American Bridge Co. last month booked orders for 24,000 tons, while its output was about 50,000 tons. In the Chicago district, estimates were called for on about 10,000 tons of structural material. The demand for wire products shows some improvement.

Lake Ore Shipments

The shipment of ore from the Lake Superior region has practically ceased. The movement for November amounted to 4,200,000 tons, a gain of 500,000 tons, compared with the same month last year. The lake movement for the season will be about 41,500,000 tons to which will be added about 1,000,000 tons of shipments by rail. The entire movement by lake and rail last year was 38,522,239 tons. In December, 1906, 540,000 tons were shipped, but this year the movement in the final month will probably not be so heavy. A large majority of vessels will be idle after this week.

Blast Furnace Production

Our monthly blast furnace statistics show a production for November of 1,815,224 tons, against the record month of October, when 2,359,690 tons were made. The decrease of 544,466 tons does not fully represent the curtailment in progress, as the number of furnaces in blast Dec. 1 was 227, against 314 in blast Nov. 1. Some of the latter were active a part of November. The statistics for December will undoubtedly indicate a very much larger decrease than those for November, but this rapid blowing out of furnaces will certainly hasten the time when production will be less than demand. Furnace operators are showing a determination not to sell below cost, and the curtailment program is being rigidly adhered to to prevent an accumulation of stocks, which would have a most depressing effect upon the market.

LOCOMOTIVES ORDERED.

Toronto, Can., Dec. 3.—The Grand Trunk railway has placed orders for 80 locomotives, representing a total cost of about $1,500,000 as follows: Locomotive & Machine Co., Montreal, 20 Richmond compound consolidated engines, weighing 211,200 pounds each, and 30 simple road engines of 121,688 pounds each; Baldwin Locomotive Works, 10 single mogul engines, 161,976 pounds each; 10 10-wheel passenger engines, 167,300 pounds each, and 10 switch engines of 139,500 pounds each. In addition the Grand Trunk Pacific railway has ordered 20 simple road engines, 121,688 pounds each, from the Canadian Foundry Co., Toronto, and 30 of the same type and weight from the Locomotive & Machine Co., Montreal.

THE WEEK IN IRON CENTERS

PITTSBURG.

Many Suspensions on Contracts Released—Large Mill Capacity Idle.

Office of THE IRON TRADE REVIEW,
521 Park Bldg., Dec. 3.

The money situation is easier, collections are reported a little better, and the number of suspensions are fewer, but the latter condition is not indicative of any improvement when the vast volume of previous suspensions is taken into consideration.

The good feature which developed during the week is the large number of suspensions that have been released and manufacturers instructed to ship material as soon as possible. This is taken as an indication that consumers who have allowed their stocks to run down are now in need of the material and have begun in earnest the hand-to-mouth buying that is expected to make up the bulk of new business until there is a general resumption.

There has been no change in prices of finished lines and the lower quotations on pig iron and scrap are nominal, inasmuch as there have been no sales upon which to base a fair market quotation. Prices now quoted cover a wide range, are asking prices, and in most instances can be shaded at least 50 cents. The average selling price of Bessemer pig iron during the month of November was $19.75 valley, or $20.60 delivered Pittsburg. Bessemer pig iron is now being offered for prompt delivery at between $18 and $19 valley. Northern No. 2 foundry iron is quoted at $18 and there is very little inquiry.

While several plants, among them the steel works of the Brown-Bonnell plant of the Republic Iron & Steel Co., have resumed operation, several others have gone down, and those that have resumed have done so for no definite period. Among the plants shut down is that of the Youngstown Sheet & Tube Co., at Youngstown. The Carnegie Steel Co. has not added any new plants to those shut down, but now has six in all, with a daily ingot capacity of 7,500 tons aside from finishing capacity, running on slow time. It is estimated that 65 per cent of the steel mill capacity of the leading interest is not in operation.

The Crucible Steel Co. of America has given notice of a 10 per cent reduction in wages to all employes receiving over $60 per month, effective Dec. 1. Several independent operators in the Connellsville coke region have reduced wages 12½ per cent and at a meeting of operators to be held in Uniontown next Friday a general reduction of from 12½ to 20 per cent, which represents advances made during the past two years, will be voted upon.

An improvement in the tin plate business is noted during the week. The leading producer has taken on considerable new business and is receiving specifications from can makers for as far ahead as they have bought for next year's requirements. In this line one 10-mill independent manufacturer started his plant after being down several weeks. The sheet business is light as far as contract business for forward deliveries is concerned, but there is a considerable number of hurry up orders, although the aggregate tonnage is not large.

The improvement in sentiment seems to be general, although investigation has shown it to be "spotty", some districts showing indications of recovery more quickly than others. Summing up the expressions of manufacturers as a whole, the feeling is that the new business for some time to come will be of the hand-to-mouth order, consumers buying only for immediate requirements, but that within a short time, as stocks run down, and money continues to get easier, this short order stuff for prompt shipment will develop into a very respectable volume.

Pig Iron.—The average monthly selling price of Bessemer pig iron during November was $19.75 valley furnace, and was based on sales of less than 4,000 tons, total. Bessemer pig iron is now quoted nominally at $19 valley, but on a firm offer this can be shaded at least 50 cents. Basic pig iron is nominally quoted at $18 valley furnace, but during the past week a sale was made at $17.80, or possibly a shade less. Although pig iron manufacturers have no definite agreement as to the selling price of pig iron during the present period of depression, there is a tacit understanding that furnaces will be kept in operation only until the iron already sold has been made, when they will blow out or bank and wait until the situation improves and there is some demand for pig metal. The stocks of Bessemer and basic iron in the valleys are estimated between 15,000 and 20,000 tons, all of which has been sold but against which there are many orders suspending shipment. Except for iron in the hands of middlemen and brokers there is no effort being made to sell. There has been some little inquiry out for foundry iron and $18 valley has been quoted. A few scattered inquiries for small lots of foundry iron and malleable Bessemer for next year are in the market. They are not considered seriously, but are looked upon as feelers. We make no attempt to guess at next year's quotations, but for delivery during the remainder of the month we make the following nominal quotations, based on asking prices rather than actual sales:

Bessemer, Valley	$19.00
Bessemer, Pittsburg	19.90
No. 1 Foundry, Pittsburg	19.65
No. 2 Foundry, Pittsburg	18.90
Gray Forge, Pittsburg	18.40
Basic, Valley	17.50 to 18.00
Basic, Pittsburg	18.40 to 18.90

Ferro-Manganese.—This market is devoid of interest or incident, there being no inquiry. A large percentage of steel makers are either shut down or running slow time. Ferro-manganese, foreign, 80 per cent is quoted $50 to $51, Pittsburg.

Imported 50 per cent ferro-silicon is quoted $93 Pittsburg on forward deliveries; domestic 12 per cent, $34; 11 per cent, $33; 10 per cent, $32. The lower grades of imported ferro-silicon are quoted 50 cents lower. These quotations are applicable to Pittsburg territory.

Sheets.—While there is a little hurry-up hand-to-mouth business being received at the mills, the aggregate new tonnage does not amount to much, and represents only the cleaned up condition of jobbers who are ordering from the mills only as they sell the goods. Independent mills not running attribute various reasons for this condition, the most general being that with the present situation they are not desirous of adding materially to their accounts receivable. We continue to quote:

Black steel sheets, one pass, cold rolled, Nos. 11-12, 2.20c; Nos. 13-14, 2.25c; Nos. 15-16, 2.30c; Nos. 17-21, 2.35c; Nos. 22-24, 2.40c; Nos. 25-26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 29, 2.75c; No. 30, 2.85c; galvanized Nos. 10-11, 2.65c; Nos. 12-14, 2.75c; Nos. 15-16, 2.85c; Nos. 17-21, 3.00c; Nos. 22-24, 3.15c; Nos. 25-26, 3.35c; No. 27, 3.55c; No. 28, 3.75c; No. 29, 4.00c; No. 30, 4.25c; blue annealed, No. 10 and heavier, 1.85c; Nos. 11-12, 1.90c; Nos. 13-14, 1.95c; Nos. 15-16, 2.05c. Corrugated roofing, $1.90 per square for No. 28 painted, 2½ inch

corrugation, and galvanized, $3.25 per square for No. 28.

Tin Plate.—The sentiment in the tin plate trade has improved to a marked degree during the past week, and new business taken on will necessitate the starting of a large number of mills that have been shut down during the depression. Can manufacturers have expressed the opinion that they expect 1908 to be a good year, and consequently are beginning to make their purchases and specifying against their first quarter contracts. One large independent tin mill plant which has been down for some time resumed operations on Monday of this week. We quote as follows:

Coke tin plate, 100-pound basis, 14 x 20, $3.90 f. o. b. mill, Pittsburg district. Terms, 30 days, less 2 per cent for cash in 10 days.

Rails and Track Material.—The past week has been better than many of its predecessors, in that while no new standard rail business was taken on, several shipment suspensions have reserved some capacity for next year and during the week talked quite freely of placing 1908 contracts for full requirements, nothing definite has been closed. Rail mills are running exceedingly light. The total new light rail business for the week with the leading interest did not exceed 300 tons. On the present American Association specifications we quote as follows:

Fifty-pound and heavier, 500-ton lots and over, $28; carloads and less than 500 tons, $30; less than carload lots, $32; 8-pound, $38; 12-pound, $34 to $37; 16-pound, $32; 20-pound, $31; 25 to 45-pound, $30; angle splice bars for standard sections, $1.65; standard spikes, $1.90 Pittsburg; hand spikes, $2 to $2.05 Pittsburg.

Steel.—The leading interest has practically 65 per cent of its steel making capacity shut down. These mills include no mills not already mentioned, there being six in all. The steel works of Brown-Bonnell plant of Republic Iron & Steel Co. resumed operations on Monday of this week for a short run. The plant of the Youngstown Sheet & Tube Co., Youngstown, is practically shut down, but only for a short time. There is no demand for semi-finished steel and we continue to quote Bessemer and open-hearth billets at $28 Pittsburg, axle and forging billets at $31 Pittsburg and sheet and tin bars $31.

Hoops and Bands.—This market is exceedingly quiet and mills are running slow, there being no new business and a large part of contract tonnage under suspension, although there have been cases during the week where consumers asked for quick deliveries on small lots. We continue to quote:

Hoops in carload lots, 2c; in less than carload lots, 2.10c; bands, 1.60c; base half extras as per standard steel.

Merchant Bars.—While as a general proposition the steel bar business is not as flat as some other standard lines there is very little going on. Suspensions are less numerous and a few of the former suspensions have been released, consumers asking for quick shipments where the financial stringency has warranted taking on new material. Prices are very firm and while there is no guarantee given buyers that there will be no decline, there is a virtual agreement among manufacturers that there will be no change in prices. The bar iron market is nominal with very little moving, and we continue to quote:

Common iron bars, 1.60c to 1.65c Pittsburg in carload lots and over, 1.65c to 1.70c in less than carloads; 1.60c base Pittsburg, plus freight to point of shipment on western deliveries; Bessemer steel bars, 1.60c net for future deliveries; 1.85c to 1.95c out of stock; plow and cultivator, 1.60c net; channels, angles, zees, tees, under three inches, 1.70c, all f. o. b. Pittsburg. The following differentials are maintained on steel: Less than 2,000 pounds, 0.10c advance; less than 1,000 pounds of a size, 0.30c advance. Cold rolled and ground shafting, 50 per cent off in carloads, and 45 per cent in less than carloads, delivered in base territory; open-hearth spring steel, 2.25c to 2.50c; sleigh shoe flats, 1.60c to 1.65c; smooth finished machinery steel, 1.90c to 2c; toe calk, 2.10c to 2.15. Planished and machine straightened tire steel is 1.80c base. Iron finished tire under 1½ by 1½ inches, 1.75c; iron finished tire, 1½ to ½ inches and over, 1.60c base. All tire subject to ½ extra on the steel card.

Merchant Pipe.—Several of the independent mills are running at reduced speed and one is shut down entirely for this week. The leading interest has not found this necessary to any great extent on account of heavy business which has not been suspended. The only new business noted during the week has been on small lots or carload orders. Prices on steel pipe are being firmly maintained, although on iron pipe 71 and 5 off is quoted on ¾ and 2-inch, and on sizes 2-inch to 6-inch 70 and 5 off is quoted. On steel pipe we continue to quote the following official discounts of the leading interest to consumers in large lots:

	—Steel—	
	Black.	Galv.
⅛ and ¼ inch	65	49
⅜ inch	67	53
½ inch	69	57
¾ to 6 inches	73	63
7 to 12 inches	70	55
EXTRA STRONG PLAIN ENDS.		
⅛ to ¾ inch	58	46
½ to 4 inches	65	53
4½ to 8 inches	61	49
DOUBLE EXTRA STRONG PLAIN ENDS.		
½ to 8 inches	54	43

Boiler Tubes.—The situation is unchanged, prices are firm, and we continue to quote the following discounts:

	Iron.	Steel.
1 to 1½ inch	42	47
1¾ to 2¼ inch	42	59
2½ inch	47	61
2¾ to 5 inch	52	65
6 to 13 inch	42	59

2¼ inches and smaller, over 18 feet, 10 per cent net extra.
2¾ inches and larger, over 22 feet, 10 per cent net extra.

Wire Products.—New business has fallen to a low mark and specifications are light except on an occasional small order for prompt shipment. Prices are firm as follows:

Wire nails, jobbers' carload lots, $2.05; retailers' carload lots, $2.10; less than carloads, $2.15; painted barb wire, $2.20 for jobbers in carloads; retailers in carloads, $2.25; and less than carload, $2.35; with 30c for galvanizing; plain wire, 1.90c for jobbers, and 1.95c by carload.

Coke.—Although there have been four or five inquiries for furnace coke in the market on 1908 contracts and none of them for less than six months' supply, producers are reluctant about making quotations. In the first place, the labor situation will figure largely into next year's prices. Already several of the independent coke producers have reduced wages from 12½ to 20 per cent and have shut down about 40 per cent of their capacity. The reduction in wages is about equal to advances made during the past two years. Foundry coke is moving very slowly, and additional suspensions of shipments by foundries which are cutting down their shipments are received daily. Prices are purely nominal and with no real market. We quote foundry coke $2.75 to $2.85 at the ovens, and furnace coke nominally $2.15 to $2.25 at the ovens.

Old Material.—The scrap market is absolutely inactive, and a 100-ton transaction would be a subject of extended comment. We quote the following purely nominal prices, gross tons, delivered in the Pittsburg district:

Heavy melting scrap, $13.50 to $14; re-rolling rails, $15 to $15.50; bundled sheet scrap, $11 to $11.50; iron axles, $21 to $21.50; old iron rails, $13 to

$19; No. 1 wrought scrap, $14.50 to $15; old car wheels, $20 to $20.50; low phosphorus scrap, $18 to $18.50; machine shop turnings, $7.50 to $8; cast borings, $6 to $7; No. 1 cast scrap, $15 to $16.

CHICAGO.

Some Signs of Improvement, but Some Prices Are Lower.

Office of THE IRON TRADE REVIEW,
1362 Monadnock Block, Dec. 3.

The optimist would find in the sentiment of the past week some evidences of a more cheerful feeling. A little inquiry for pig iron, 10,000 tons or such a matter of structural material submitted for estimates, a noticeable cessation in the demand for cancellations, a less constrained atmosphere in banking circles, all are little things, but signs to the hopefully inclined that the toboggan is striking easier grades. The number of unemployed undoubtedly increased during the week, but there were no striking curtailments. The furnaces in this district will go out as they conveniently can, some repairs will probably be made, and the sooner the period of minimum production is entered upon, the more quickly will it be ended. Trade from store is a little more brisk, but in most directions a uniform quiet prevails. Several instances of lower prices are recorded, but differences are now less marked and there is a growing belief that bottom is being touched in many places.

Pig Iron.—Of the inquiries for an aggregate tonnage amounting to 4,500 tons which came into the market a week ago, including one from the Grand Crossing Tack Co. for 2,000 tons, and one from Battle Creek, Mich., for 1,500 tons for delivery in the first six months, not a ton has been turned into orders as yet. Prices quoted were pretty nearly at rock-bottom, but did not bring out the business. There is some little demand for carload lots, but furnaces are continuing their plans for blowing out. In this district there remain active of the merchant furnaces, the Spring Valley furnace, one stack at Mayville, two Iroquois stacks and the Zenith furnace at Duluth. Of these, one Iroquois is expected to be blown out at any time and the other will follow in a short while if conditions do not change. The same is true of the stack of the Spring Valley Iron Co. The shutting down of some of these stacks has been delayed, not because of any demand for iron, but in order to use up coke on hand. The continued curtailment is not necessarily significant of increasing weakness in the situation, but rather indicative of greater strength inasmuch as it amounts to balancing demand and supply accounts.

We continue to quote southern No. 2 at $15.00 and there is no doubt that iron for delivery during the balance of the year can be bought at that price, at least in the volume in which all buying is being done at present. The appearance of a large tonnage in the market would undoubtedly stiffen the price at once. It is also conceivable that a round tonnage for delivery next year would not bring out as low prices as the same tonnage for delivery in December. Northern No. 2 may be had at $19 delivered Chicago, but some interests are not quoting at this level and will not sell on that basis. We quote for delivery in December as follows:

Lake Superior Charcoal	$25.00 to 25.50
Northern Foundry No. 1	20.00 to 20.50
Northern Foundry No. 2	19.00 to 20.00
Northern Foundry No. 3	18.50 to 19.00
Southern Foundry No. 1	19.85 to 20.35
Southern Foundry No. 2	19.35 to 19.85
Southern Foundry No. 3	18.85 to 19.35
Southern Foundry No. 4	18.35 to 18.85
Southern No. 1 Soft	19.85 to 20.35
Southern No. 2 Soft	19.35 to 19.85
Southern Gray Forge	18.85 to 19.35
Southern Mottled	18.35 to 18.85
Southern Silveries, 4 per cent Silicon	24.35 to 24.85
Southern Silveries, 5 per cent Silicon	25.35 to 25.85
Southern Silveries, 6 per cent Silicon	26.35 to 26.85
Jackson Co. Silveries, 6 per cent	30.40
Jackson Co. Silveries, 8 per cent	32.40
Jackson Co. Silveries, 10 per cent	34.40
Malleable Bessemer	22.50 to 23.00
Standard Bessemer	20.15 to 20.65
Valley Basic	20.85 to 21.35
Alabama Basic	21.35 to 21.85

Billets and Rods.—Nothing of interest developed during the week in the matter of billet transactions and there is no basis for quoting other than the prices which have been asked for some time. We quote f. o. b. Pittsburg, rolling billets, $28; Bessemer wire rods, $37; open-hearth rods, $38 and sheet bars, $31 to $31.50. Forging billets are held at from $33 to $34 Chicago.

Merchant Bars.—If the situation this week is capable of distinction at all from the conditions prevailing a week ago, it is in the direction of a more cheerful aspect. A few inquiries have been received for bar iron and a better inclination to accept deliveries is noted in some quarters. There is no disposition to quote below 1.75c Chicago, although it is reported that this price was shaded on a delivery at Kansas City, Mo. The week begins with a better trade from store and in view of the fact that consumers' stocks are down practically to a minimum, buying is of a very substantial and urgent nature. We quote for carload lots, Chicago delivery, as follows:

Bar iron, 1.75c to 1.78c; soft steel bars and bands, 1.78c, half extras; soft steel angles, less than 3 x 3, 1.88c; hoops, 2.18c base, full extras; planished or smooth finished tire steel, 1.98c; iron finish, up to 1½ x ½ inch, 1.93c base; iron finish, 1½ to 1½ inch and larger, 1.78c base; channel for solid rubber tire, ¾ to 1 inch, 2.28c, and 1⅛ inch and larger, 2.18c; smooth finished machinery steel, 2.18c; flat sleigh shoe, 1.83c; concave and convex sleigh shoe, 1.93c; cutter shoe, 2.36½c; toe calk steel, 2.33c; railway spring, 1.98c; crucible tool steel, 7c to 9c, with higher prices asked on special grades. Quotations on shafting are 54 per cent off the list f. o. b. Pittsburg for carload lots, and 48 per cent off for less than carload lots. On iron and steel bars from local stocks, we quote as follows: Bar iron, 2.25c, full extras; soft steel rounds, and square, 3-inch and larger, $2 per 100 pounds base; flats, 2 inches to 4 inches by ⅛ inch and larger, $2 per 100 pounds base, 4½ inches by 5 inches and 6 inches by 5/16 inch and thicker, $2 per 100 pounds base; all ovals, half rounds, $2 per 100 pounds base; steel bands, $2 half extras; soft steel hoops, $2.50 full extras. Other sizes not mentioned above, $2 per 100 pounds base, plus half extras.

Plates.—Trading in plates is very light, practically all business being on old contracts. We quote:

Plates, ¼-inch and heavier, 6¼ to 100 inches wide, either universal or sheared, 1.70c Pittsburg base. For extras see Pittsburg report. Freight rate to Chicago, 18c per 100 pounds for carload lots, and 21c for less than carload lots. Jobbers' prices for shipment from local stocks are as follows: Tank steel, ¼ inch and heavier up to 72 inches wide, 2.20c; 3/16 inch up to and including 60 inches wide, 2.30c; 3/16 inch, 72 inches wide, 2.55c; No. 8 up to 60 inches wide, 2.40c. Flange steel, 25c extra; heads, 25c extra.

Sheets.—There is no further change in the price of sheets and the lack of inquiry makes the question of price secondary. We quote:

Black sheets, Nos. 8, 9 and 10, 1.90c Pittsburg; No. 28, 2.60c Pittsburg. Galvanized sheets, No. 28, 3.75c Pittsburg. Freight to Chicago, 18c per 100 pounds for carload lots, and 21c for less than carload lots. Jobbers' prices on carload lots and less from store are as follows:

No. 10, 2.30c to 2.35c; No. 12, 2.35c to 2.40c; No. 14, 2.40c to 2.45c; No. 16, 2.50c to 2.60c; Nos. 18-20, 2.70c to 2.80c; Nos. 22-24, 2.75c to 2.85c; No.

26, 2.80c to 2.90c; No. 27, 2.85c to 2.95c; No. 28, 2.95c to 3.05c; No. 30, 3.25c to 3.35c. Galvanized sheets, Nos. 10 to 16, 3.20c to 3.30c; Nos. 18 to 20, 3.30c to 3.40c; Nos. 22 to 24, 3.40c to 3.50c; No. 26, 3.60c to 3.70c; No. 27, 3.80c to 3.90c; No. 28, 4.00 to 4.10c; No. 30, 5.20c to 5.25c.

Structural Material.—The tonnage contracted for during the week did not aggregate more than a few thousand tons. Estimates were asked on about 11,000 tons, but the placing of that business is quite uncertain. No change in the situation as regards suspended undertakings is apparent. We quote:

Beams and channels, 3 to 15 inches inclusive, 1.70c Pittsburg. For extras see Pittsburg report. Freight rate from Pittsburg to Chicago, 18c per 100 pounds for carload lots, and 21c per 100 pounds for less than carload lots. Quotations from store are as follows:

All angles, 3 inches and larger, including 6 inches, $2.05 per 100 pounds; angles, over 6 inches, $2.15 per 100 pounds base; beams, 3 to 15 inches inclusive, $2.05 per 100 pounds base; channels, 3 inches and larger, $2.05 per 100 pounds base. Less than carload lots are $1 a ton higher than foregoing prices.

Rails and Track Supplies.—Railroad buying of all kinds in this district is being held up. Hope is expressed for a resumption after Jan. 1, but the turning point or the foundation for it is not in sight. We continue to quote:

Bessemer rails, $28 to $30; less than 500-ton lots, $32; open-hearth rails, $29; light rails, Bessemer, 25 to 45-pound sections, $32; 20-pound, $33; 16-pound, $35; 12-pound, $35; and lighter sections down to 8-pound, $42, all f. o. b. mill. Track supplies vary in price according to quantity and delivery. On orders accompanying rail contracts for future delivery, we quote, f. o. b. Joliet: Angle bars, 1.65c; spikes, 2.00c to 2.10c; bolts with square nuts, 2.50c to 2.60c; with hexagon nuts, 2.75c. For carload lots or less, for prompt shipment, the following prices are asked: Angle bars, 2.25c to 2.75c; spikes, 2.40c to 2.50c; bolts with square nuts, 2.85c; with hexagon nuts, 3c.

Cast Iron Pipe.—There is practically no inquiry for pipe for contracts of any size, either for industrial or municipal purposes and prices like those of pig iron are weak and uncertain. We quote 4-inch water pipe $35; 6 to 12-inch, $34; larger sizes, $33; gas pipe, $1 a ton higher.

Merchant Pipe and Boiler Tubes.—There is very little activity in this direction and inquiry is light.

We quote mill discounts, Chicago delivery, carload lots, as follows: On steel pipe, jobbers are allowed a concession of one point and five per cent additional from the schedule in force:

	Steel. Black.	Galv.
¾ to 6 inches, inclusive	71.2	61.2
BOILER TUBES.		
	Steel.	Iron.
2¾ to 5 inches, inclusive	62.2	49.2

Mill quotations on iron pipe are from four to five points higher than above. A concession of one point from the following quotations is allowed by Chicago jobbers on carload orders for shipment from local warehouse stocks. We quote for less than carload lots as follows:

MERCHANT PIPE.	Black.	Galv.
⅛ to ¼ inch	61	45
⅜ inch	63	49
½ inch	65	53
¾ to 6 inches	69	59
7 to 12 inches	65	50

Minimum prices for wrought iron pipe, carload lots or greater, from Chicago stocks, are as follows: ⅛-inch to ¼-inch, 55; ⅜-inch, 57; ½-inch, 59; ¾-inch to 6 inches, 64; 7 inches to 12 inches, 59. Boiler tubes from store are unchanged at 60 off for steel, 47½ for iron, and 42½ for seamless, base sizes, 2⅛ inches to 5 inches.

Wire Products.—A condition somewhat improved apparently exists in the demand for wire and nails and a stronger tone prevails. A resumption of inquiry from consumers is expected to begin actively during the first quarter though undoubtedly in moderate volume as compared with the transactions of the past year. We quote to jobbers, Chicago delivery, as follows:

Wire nails, $2.23; painted barb wire, $2.38; galvanized barb wire, $2.68; smooth annealed wire, $2.08; smooth galvanized wire, $2.38; polished staples, $2.23; galvanized staples, $2.63. Carload lots to retailers, 5 cents higher; less than carload lots, 15 cents higher.

Coke.—That a number of furnaces are still in blast that would otherwise be out may be attributed to the coke movement. Shipments intended for furnaces now idle were diverted in considerable volume to the stacks still active and now smelting is being continued only to work off this coke. There is no change in the demand and we quote Connellsville 72-hour foundry coke at $2.85 to $3 and standard Connellsville furnace coke at $2 to $2.25.

Old Material.—There is no buying save where the purchaser is convinced he is getting an exceptionally good price. Declines in prices are not so marked as when the market was at higher levels, but conditions are none the less weak. The Chicago & Northwestern Railway has sent out a list covering about 2,800 tons. We quote, gross tons in the first paragraph, as follows:

Old Car Wheels	$19.50 to 20.00
Old Iron Rails	15.50 to 16.00
Re-rolling Rails (3 ft. and over)	13.50 to 14.00
Old Steel Rails (3 ft. and under)	13.75 to 14.25
Light Section Relayers, 45 lbs. and under, subject to inspection	21.00 to 23.00
Relaying Rails, subject to inspection	19.00 to 19.50
Frogs, Switches and Guards	12.00 to 12.50
Heavy Melting Steel	12.00 to 12.50

We quote net tons as follows:

No. 1 R. R. Wrought	$12.00 to 12.50
No. 2 R. R. Wrought	11.00 to 11.50
Knuckles, Couplers and Springs	11.00 to 11.50
Shafting	15.50 to 16.00
Iron Car Axles	17.00 to 17.50
Steel Car Axles	17.50 to 18.00
Dealers' Forge No. 1	9.50 to 10.00
Pipes and Flues	8.00 to 8.25
No. 1 Cast, 150 lbs. and less	14.50 to 15.00
No. 1 Mill	7.50 to 8.00
Mixed Busheling (Nos. 1 and 2)	8.50 to 9.00
Country Sheet	8.00 to 8.50
No. 1 Boiler Cut	8.00 to 8.50
Boiler Punchings	11.00 to 11.50
Cast Borings	6.00 to 6.50
Mixed Borings, etc	6.00 to 6.50
Machine Shop Turnings	7.50 to 8.00
Railroad Malleable	11.00 to 11.50
Agricultural Malleable	10.25 to 10.75
Stove Plate and Light Cast Scrap	11.75 to 12.25
Old Iron Splice Bars	13.00 to 13.50

CINCINNATI.

More Interest in Next Year's Requirements—Lower Quotations.

Office of THE IRON TRADE REVIEW,
First National Bank Bldg., Dec. 3.

Pig Iron.—Buying continues limited and the market is dull. The generally accepted quotation for southern iron is $15 Birmingham for No. 2 foundry, but $14.50 can be done. The situation so far as sellers are concerned is irregular. Some of the leading producers in the south are not inclined to make any effort to follow the market while others are competing sharply for the little business available. There is a better feeling in a general way and the market is regarded as nearing the cost line and is believed to be close to bottom figures for the present. Several inquiries are pending which involve a fair tonnage and this week is expected to develop what can be done for the first quarter of 1908. A large manufacturer of agricultural implements is figuring on a tonnage which is expected to reach 7,500 tons, an Ohio manufacturer is asking for prices on 1,000 tons and the Michigan inquiry for 2,500 tons is still pending. There is also an inquiry for 1,000 tons of malleable iron from an Ohio manufacturer.

Southern furnaces have not indicated what they would be willing to accept for next year and most of the

sales agencies are without schedules on which to make quotations, although several have authority to quote $15 Birmingham. It may be said however, that it is currently believed that some of the business now under consideration will bring out $14 Birmingham on southern iron for first half delivery. There is more interest shown in next year's requirements and correspondence in the offices of sales agencies indicates that some buyers are considering their 1908 supply. Southern production has been much curtailed as will be shown by the following list of the stacks in and out of blast covering merchant furnaces on foundry iron in what is known as the southern group: Rockwood, one stack in and one out; Dayton, two in, none out; Citico none in, one out; Sheffield, one in, two out; Chattanooga none in, one out; Rockdale, one in, none out; Woodstock, one in, one out; Woodward, two in, one out; Tennessee Coal, Iron & Railroad Co., one in, 11 out; Republic Iron & Steel Co., one in, two out; Sloss, two in, five out; Trussville, none in, one out; Rising Fawn, none in, one out; Embreeville, one in, and none out; Warner, one in and none out; Alabama Consolidated, two in and two out; Napier, one in and none out; Alabama City, none in and one out; Tuscaloosa none in and one out; Williamson, none in and one out; Rome, none in and one out; Vanderbilt, one in and none out; Bon Air, two in, none out; Clarksville, none in, one out; Standard, one in, none out. This shows that out of a total of 55 southern stacks 21 are in blast and 34 are out. The four furnaces of the Tennessee Coal & Iron Co. at Ensley are running on basic. It is further reported that next week will show additional idle stacks. There is but little unsold tonnage on furnace yards and with production reduced southern iron is not accumulating rapidly. We quote for prompt delivery, delivered Cincinnati, as follows:

Southern Foundry No. 1	$18.25 to 18.75
Southern Foundry No. 2	17.75 to 18.25
Southern Foundry No. 3	17.25 to 17.75
Southern Foundry No. 4	16.75 to 17.25
Southern No. 1 Soft	18.25 to 18.75
Southern No. 2 Soft	17.75 to 18.25
Southern Gray Forge	16.50 to 16.75
Northern No. 1 Foundry	19.70 to 20.20
Northern No. 2 Foundry	19.20 to 19.70
Northern No. 3 Foundry	18.70 to 19.20

Finished Material.—The market is quiet and not materially changed. Specifications on contracts are light. Retail orders are moderate. Small orders are filled from stock at the following prices:

Angles, 3 x 3 and over, 2.15c to 2.25c; beams and channels, 15 inches and under, 2.15c; small angles and architectural channels, 2.10c base; plates ¼-inch and heavier, 2.10c; 3-16 inch, 2.20c; No. 8, 2.20c; sheets (blue annealed) No. 10, 2.30c; No. 12, 2.35c; No. 14, 2.40c; No. 16, 2.50c; box annealed sheets, Nos. 18 and 20, 2.65c; Nos. 22 and 24, 2.75c; Nos. 25 and 26, 2.80c; No. 27, 2.85c; and No. 28, 2.95c. Iron and steel bars, $2 base; boilers tubes, 62 per cent off base; turnbuckles, 45 per cent off; rivets, 3.15c base; cold rolled shafting, 45 per cent off list; steel tire, 2.10c base.

Coke.—Transactions are meager in both furnace and foundry coke. Consumers are giving but little attention to next year's requirements and trading in spot coke is limited, as deliveries on contracts are covering requirements. Prices in the leading coke producing districts are as follows:

	PER TON
Wise County Furnace Coke	$2.30 to 2.50
Wise County Foundry Coke	2.85 to 3.00
Pocahontas Furnace Coke, prompt shipment	2.25 to 2.35
Pocahontas Foundry Coke	2.75 to 3.00
Connellsville Furnace Coke, prompt shipment	2.30 to 2.50
Connellsville Foundry Coke	2.90 to 3.25
New River Foundry Coke, prompt shipment	3.00 to 3.10
New River Furnace Coke, contract	2.75 to 2.90

Old Material.—The market is dull and easy with quotations showing further weakness. We quote dealers' prices as follows.

Old No. 1 R. R. wrought, net tons	$12.50 to 13.50
Cast machine and fdy., net tons	13.50 to 14.50
Old iron rails, gross tons	18.50 to 19.50
Old steel rails (re-rolling) gross tons	14.50 to 15.50
Old short lengths, gross tons	14.50 to 15.50
Old iron axles, net tons	19.50 to 20.50
Heavy melting scrap, gross tons	14.00 to 14.50
Stove plate, net tons	10.50 to 11.50
Wrought turnings, net tons	7.50 to 8.50
Cast borings, net tons	5.50 to 6.50
Car wheels, gross tons	19.50 to 20.50

PHILADELPHIA.

Little, if Any, Improvement in the Pig Iron Market.

Dec. 3.

Pig Iron.—Despite the improved feeling over the financial situation, which, of course, lies at the bottom of all the present troubles in the iron and steel trade, it cannot be said that there is any distinct betterment noticeable in the pig iron market here. Perhaps the sentiment is a little better, but prices have continued to sag and curtailment of production has been pursued vigorously. Since last week's report three more furnaces have been blown out. These are the Macungie and Topton stacks of the Empire Iron & Steel Co., which now has four of its eight furnaces out of commission, and the Keystone furnace of the Reading Iron Co. Unless there is a remarkable change for the better in the next few weeks, the number of idle plants will be considerably increased in the near future. The necessity for this was shown at the recent meeting of the Eastern Pig Iron Association, when reports showed orders on hand for approximately 175,000 tons of pig iron. As the capacity of the furnaces now in operation is not over 60,000 tons a month, this might seem a fairly promising outlook, but so many cancellations and requests for delays in shipments have come in and the amount of new business is so small, that it was generally agreed that large reductions in productive capacity are essential if anything like the present prices is to be obtained. Furnaces now average an accumulation of about six days' output, and it is desired not to increase this, if possible. There has been in increase in inquiries, and at least one good-sized order has been placed, calling for 5,000 tons of basic at about $17.50. Most of the orders, however, still continue in very small lots. Prices have declined a little, and may be quoted about as follows:

No. 1X Foundry	$19.25 to 19.75
No. 2X Foundry	18.75 to 19.25
No. 2 Plain	18.25 to 18.75
Standard Gray Forge	16.50 to 17.00
Basic	17.50 to 18.00
Low Phosphorus	25.50 to 26.00

Finished Material.—There is no particular change noticeable in the situation. New business comes in in such small volume and so irregularly that some mills operate only in alternate weeks, or with half their regular force. At Conshohocken this is the week when all the plants close. Prices continue at the figures already quoted, as follows: Beams, channels and angles, according to specifications, 1.85c to 1.90c; refined iron bars, 1.75c to 1.80c; steel bars, 1.75c to 1.85c; plates, 1.85c to 1.90c.

Old Material.—With absolutely no demand from the mills, scrap can move in only one direction, and that is downward. This is what it has been doing, and prices show a lower range than ever, as follows:

Old steel rails	$14.00 to 15.00
No. 1 steel scrap	12.00 to 12.50
Old steel axles	19.50 to 20.00
Old iron axles	22.00 to 23.00
Old iron rails	17.50 to 18.00
Old car wheels	19.00 to 20.00
Choice scrap R. R. No. 1 wrought	14.50 to 15.00
No. 1 yard scrap	13.50 to 14.00
Machinery scrap	16.00 to 16.50
Low phosphorus scrap	16.50 to 17.00
Wrought iron pipe	12.00 to 12.50
No. 1 forge fire scrap	12.00 to 12.50
No. 2 forge fire scrap, ordinary	9.50 to 10.00
Wrought turnings	10.00 to 10.50
Axle turnings, heavy	11.00 to 11.50
Cast borings	7.75 to 8.25
Stove plates	13.00 to 13.50

The Atwater Mfg. Co., Southington, Conn., maker of hardware, is rushed with orders, and Manager Bradley says that the concern has on hand business enough to keep it going for three months.

NEW YORK.

Policy of Co-operation in Maintaining Prices Has Good Effect.

Office of THE IRON TRADE REVIEW, Room 1005, No. 90 West St., Dec. 3.

Pig Iron.—Extreme quiet continues, but there are evidences that a number of large consumers are sounding the market with a view to covering their requirements for the early part of next year. This is the brightest feature of the present situation and is giving rise to a distinctly more hopeful feeling on the part of producers. The policy of curtailment is being vigorously enforced. Eastern merchant production is now close to 50 per cent of the normal and with the blowing out of a few additional stacks which will bring output down to or slightly below this figure, will probably remain about at this level. A pipe concern has closed for 800 tons of assorted irons for delivery early in next year; a part of this was 2X and went at $17.50, furnace, though this figure is being shaded about 50 cents. There are occasional sales of basic and other irons, but each transaction establishes its own particular quotation. We quote prices, largely nominal, as follows:

Northern Foundry No. 1	$18.00 to 18.50
No. 2X Foundry	17.00 to 17.50
No. 2 Plain	16.50 to 17.00
Malleable	19.00 to 20.00
No. 2 Southern Foundry	19.00 to 20.00
Basic	17.00 to 17.50

Ferro-Manganese.—The market is quiet, with the price level unchanged from that reported a week ago, $49, tidewater.

Finished Materials.—The American Bridge Co. during November took on new contracts aggregating 24,000 tons, this total including 2,500 tons for the Madison avenue bridge and 3,500 for the Metropolitan car barns, both of which were placed on the last day of the month. The output of the American Bridge Co. shops during this period was about 50,000 tons, which probably accurately represents the total volume of business placed by all concerns as well. The policy of co-operation in the maintaining of prices is having a good effect and the situation is seemingly stronger. Bids close next Monday for the 15,000 tons of steel needed for the Manhattan bridge approach, but there is a general feeling that city finances are such that no award will be made.

In bar iron there is practically no activity, but prices are being well maintained, the policy being to curtail production rather than shade the base of 1.60c, Pittsburg. Mills are running only about half time, on an average. There is no activity in cast iron pipe, municipal work being almost entirely held up through financial difficulties. We quote:

Angles, 3 to 6 inches x ¼-inch and heavier, 1.86c; beams, 3 to 15 inches, 1.86c; tees, 3 x ¼-inch and heavier, 1.91c; plates, carloads, tank, 1.86c; marine boiler, 2.26c; bar iron, 1.76c; soft steel bars, 1.76c; sheet, No. 28, black, 2.60c.

Old Materials.—Sales are few and of extremely limited tonnage, so that the market is as inactive as a week ago. Prices are practically unchanged on the following basis for gross tons, New York delivery:

Old iron rails	$20.00 to 20.50
Old steel rails, re-rolling	15.50 to 16.00
Relaying rails	23.00 to 23.50
Old car wheels	19.50 to 20.00
Old iron car axles	17.00 to 17.50
Old steel car axles	15.50 to 16.00
Heavy melting steel	10.50 to 11.00
No. 1 railroad wrought	13.50 to 14.00
Iron track scrap	12.50 to 13.00
Wrought pipe	10.00 to 10.50
Cast borings	5.50 to 6.00
Wrought turnings	7.50 to 8.00
Heavy cast scrap	15.00 to 15.50
Railroad malleable	14.50 to 15.00
Agricultural malleable	15.00 to 15.50
Stove plate	12.00 to 12.50
Grate bars	11.50 to 12.00

BUFFALO.

Various Opinions as to the Market—Numerous Inquiries Pending.

Office of THE IRON TRADE REVIEW, 932 Ellicott Square, Dec. 3.

Pig Iron.—Although some dealers say that conditions are worse than they were four or five weeks ago, others are of the opinion that the market is gradually improving and that a buying movement, even though it be small, will commence within the next four weeks. While there are no sales reported and practically no market upon which to base quotations accurately, numerous inquiries are being received and indicate strongly that the consumers in many instances are actually in need of iron.

It is thought that should financial conditions improve suddenly, foundries start up again, and a heavy buying movement start in, there will be a shortage of the metal, and possibly a sharp rise in prices. In the meanwhile foundrymen are gradually shutting down their plants, or running on part time, until orders begin to pick up, and are buying iron only in small lots. We quote for December delivery:

No. 1X Foundry	$20.00 to 20.50
No. 2X Foundry	19.50 to 20.00
No. 2 Plain	19.00 to 19.50
No. 3 Foundry	18.50 to 19.00
Malleable Bessemer	20.00 to 20.50
Gray Forge	18.00 to 18.50
Charcoal	25.00 to 26.00

The Lowell Machine Shop, Lowell, Mass., has laid off about 500 men during the past month. Scarcity of money is given as the cause.

ST. LOUIS.

More Interest Shown by Buyers in the Pig Iron Market.

Dec. 2.

Pig Iron.—It is rumored that some sales of No. 2 foundry have been made below $15 Birmingham, but the usual asking price is $15.50. Judging from inquiries received last week, more interest is being manifested by foundrymen in covering the balance of their shipments for the remainder of this year and the first quarter of 1908. With the remarkable curtailment of production last week it is predicted by persons in the south who are familiar with the iron industry, that prices will advance on the first indication of a buying movement.

Our prices, f. o. b. Birmingham, to which $3.75 freight is to be added, follow:

No. 1	Southern	$15.50 to 16.00
No. 2	Southern	15.00 to 15.50
No. 3	Southern	14.50 to 15.00
No. 4	Southern	13.50 to 14.00

Coke.—Some requests have been received for a postponement of shipments on contract for 30 days, but a majority of melters are taking their full quota in a satisfactory manner. There is not much demand for foundry coke, most of the melters having bought for the needs over the balance of this year. A few inquiries have been received for shipments over the first few months of 1908. Our prices follow: Best grade 72-hour Connellsville foundry, $3.25 to $3.50; 48-hour furnace, $2.25 to $2.50; smelter, $1.60 to $2.15. The freight to East St. Louis is $2.80, and to St. Louis, $2.90. West Virginia foundry coke is still offered at $3 to $3.25 f. o. b. ovens, with $2.80 freight to East St. Louis, $2.90 to St. Louis, and $2.40 when destined to points beyond.

Finished Material.—Building seems to have come to a standstill, and according to the architects it will remain so until the money conditions have been entirely relieved.

Old Material.—Scrap iron dealers are very much discouraged, and can see no improvement to come in the near future.

BIRMINGHAM, ALA.

Market Quiet, but Change for Better Expected Next Month.

Dec. 2.

The first week of the last month of the year opens up with the pig iron market in the Birmingham district still very quiet, but hope being expressed on all sides that the next month will see a general improvement all around. There is no demand for

pig iron being received worthy of commenting on. The local consumption has slackened up some. The minimum number possible of furnaces is being kept in operation and there is no accumulation whatever. The iron men express the belief that on the turn of the new year there will be a decided change for the better and inquiries will commence being received and orders will go down on the order books, all of which iron will have to be produced. The large plant of the Sheffield Cast Iron Pipe & Foundry Co., at Sheffield, has been shut down because of no business. The yards at this plant are well supplied with the product. The condition at the cast iron pipe plants in North Birmingham and Bessemer is just to the contrary, a number of good orders having been recently placed in this section. There is no intention of shutting down around here as far as can be learned.

The steel industry in the Birmingham district continues to do well, in the face of adverse conditions elsewhere. The plants of the Tennessee and Southern Steel companies are all in operation. At Ensley more men are being placed at work on the new steel plant construction.

There are no inclinations to resume operations at furnaces in this section as far as can be heard of. Nothing will be done in this line until there has been an actual improvement in the demand. The most optimistic, however, do not expect the improvement to set in until after this year.

BRITISH IRON MARKET.

Improved Tone in Pig Iron—Stock Shows Further Reduction.

Office of THE IRON TRADE REVIEW,
Prince's Chambers, Corporation St.,
Birmingham, Eng., Nov. 23.

A somewhat healthier tone has been apparent in pig iron this week, partly due to the withdrawal of the weakest dealers in warrants, whose rush to get rid of their holdings greatly weakened the market. On the whole, the comparative success in resisting the most depressing reports from America has been an agreeable surprise. It is clear that supply and demand are much more nearly approximating to each other than was supposed. The stocks of Cleveland iron are now below the 100,000 tons, today's total being 98,967. Every day sees a slight reduction. But there is still further weakening of prices, which yesterday were 49s 4½d ($12.90), and for three months 48s 11d ($11.96). For No. 3 the quotation is 51s ($12.48), against 51s 9d ($12.66) a week ago. It is noteworthy that the Midland district still shows much greater strength than the North, mainly because a number of makers still have the greatest difficulty in supplying their customers. At the same time they are glad, in most cases, to book orders at rather lower prices. This reduction does not apply to the best classes of iron, such as Staffordshire cold blast, which is quite unmoved, and foundry irons keep up fairly well. In spite of enormous curtailment of production, hematite is increasingly feeble, owing, of course, to the heavy falling off in the steel trade. Where contracts are being exhausted, purchases are for small amounts for hand-to-mouth requirements, and subject to immediate delivery.

CLEVELAND.

Season's Ore Movement Approximately 41,500,000 Tons—Pig Iron Weakens.

Office of THE IRON TRADE REVIEW,
Browning Building, Dec. 3.

Iron Ore.—Sufficient figures of the lake ore shipments for November are available to show that the total season's movement for 1907 will exceed 41,000,000 tons and will probably reach 41,500,000. The month of November practically ends the season, and with one port and one harbor at another port missing the total shipments of the past month reach 3,080,570 tons, against corresponding totals of the same ports of 2,609,854 tons in November, 1906, a gain of 470,716. Escanaba was the only dock which did not show a gain in the month. The missing port, Superior, and the one dock at Escanaba in November, 1906, moved 1,124,313 tons, and if a similar record was made by the two ports this year, which seems likely, the total movement will be approximately 4,200,000, against 3,734,167 in November, 1906. Up to Nov. 1 the total movement this year was 37,041,861 tons, which with the estimate for November would make the total to Dec. 1 over 41,200,000 tons. In December, 1906, a total of 540,593 tons were shipped, and while this year's movement in the final month may fall short of last year's mark, it is expected that enough ore will be brought down to raise the total to the 41,500,000 mark for the season. A tempting rate on coal is inducing some of the shipping interests to keep their boats active longer than they had originally intended, and this fact will probably help out the December ore shipments. Most boats will be idle, however, by the time of the expiration of the season's insurance, Dec. 5. The weather at the mines has been very favorable for active work, except possibly at Ashland, where freezing has interfered somewhat with operations.

Pig Iron.—A greater tendency toward weakness is shown by pig iron in the limited volume of business being transacted. Quotations are largely nominal in the absence of sufficient tonnage to thoroughly test the market but the actual sales made indicate a willingness to shade prices for desirable business. We note the sale of 700 tons of No. 2 foundry iron for nearby delivery at about $18 Pennsylvania furnace. It is believed that better than this price could be done on any fair-sized lots. The melt in this district is showing no increase and requests for extended deliveries are no more numerous. Some piling of iron in furnace yards is being done but this has not reached any great extent, as yet. There are some inquiries for foundry iron for first quarter delivery but no business is being taken. Recent sales show basic iron to be weaker. We note an inquiry for 2,000 tons of basic for six months delivery from March 1. We quote, f. o. b. Cleveland, for the remainder of the year, as follows:

Bessemer	$19.90
No. 1 Foundry	19.00 to 19.50
No. 2 Foundry	18.50 to 19.00
No. 3 Foundry	18.00 to 18.50
No. 2 Southern	19.35 to 19.85
Gray Forge	19.00 to 19.25

Finished Material.—While there is a somewhat more cheerful feeling, which has arisen as conditions have become more nearly adjusted, business has not shown much gain in volume. Some of the larger steel interests report a slight improvement in specifications, but others have experienced the reverse during the week. It is reported that the banks are showing more willingness to discount paper than for several weeks past, and this is expected to help out the stringency in cash. Structural steel remains in fairly good shape. Some small contracts are being taken and several large ones, particularly in bridge work, are pending. Independent mills continue to cut prices on light plates, and some business is being taken in competition with the larger companies, which are holding firm. This shading is attributed to the influence of the cutting in sheets by independent mills. The bar iron situation is indicated to be weaker by the closing down of both the Empire and Union mills in this city. This is the first suspension of the latter since the iron market began to lose strength. One of the local steel mills is also still idle. There is a slight change for the better in warehouse business. Collections are not good.

Coke.—The position of coke re-

mains weak and sales are not heavy, although some inquiry is reported. Reduction of output, by the shutting down of ovens, continues. There is talk that an effort may be made to curtail production so that a higher price for furnace coke for the first half may be held, but in view of the market's present condition, success of such a movement seems unlikely. We quote furnace coke at from $2.25 to $2.50 for the remainder of the year, and high grade foundry coke at $3.25 with $2.75 for inferior brands.

Old Material.—For the first time in a number of weeks an improved feeling is noted in old material, but this has nevertheless not prevented a further decline in some grades. It is believed that the bottom of the market has been approached closely, and that a strong current of influence will be necessary to move it either way. The usual monthly offerings by railroads comprise 7,000 tons by the Pennsylvania lines west, 2,000 tons by the Big Four, 1,000 tons by the Wheeling & Lake Erie, 1,000 tons by the C. H. & D., and a list by the Erie. We have revised our prices, and quote, f. o. b. Cleveland, gross tons, as follows:

Old iron rails	17.00 to 18.00
Old steel rails (re-rolling)	14.00 to 15.00
Old steel rails (under 6 feet)	14.00 to 15.00
Old car wheels	18.00 to 19.00
Steel boiler plate	11.00 to 12.00
Steel axles	15.00 to 16.00
Malleable iron (railroad)	12.00 to 13.00
Malleable iron (agricultural)	10.00 to 11.00
Heavy steel	12.00 to 13.00
Country mixed steel	11.00 to 11.50
Low phosphorus	15.50 to 16.50

We quote net tons as follows:

No. 1 R. R. Wrought	11.50 to 12.50
No. 1 busheling	11.00 to 11.50
No. 1 machine cast	13.00 to 14.00
Iron axles	18.00 to 19.00
Axle turnings	8.00 to 9.00
Machine shop turnings	6.00 to 7.00
Grate bars	10.00 to 11.00
Pipes and flues	10.00 to 11.00
Tank iron	8.00 to 9.00
Hoop and band iron	5.00 to 6.00
Sheet iron	4.00 to 5.00
Wrought drillings	7.00 to 8.00
Stove plate	10.00 to 11.00
Cast borings	5.00 to 6.00

METAL MARKET

NEW YORK.

Dec. 3.

Copper.—The situation has become even more quiet, as there is now an entire absence of sizable lots in current business, which is confined to retail orders only. In fact, the only activity is for export account, but in this direction there has been enough activity of late to produce a slight advance in prices. We quote as follows: Lake, 13½c to 13¾c; electrolytic, 13¼c to 13½c; casting, 13c to 13¼c. There is no change in the base of sheets and wire.

Pig Tin.—There is fairly good demand for prompt metal, but when this is said the whole story is told. For prompt shipment the market is about 31¼c, but for future account the price is 1c lower.

Pig Lead.—There is brisk competition to clear out stocks in the hands of both producers and dealers, and the market is correspondingly weak, as current business is extremely limited. New York is selling at 4.10c to 4.20c and St. Louis at 4c, or even slightly lower.

Spelter.—There is little demand and stocks are accumulating. No business is being stimulated by lower prices, the current level being 4.65c to 4.75c, New York, and 4.50c to 4.60c, St. Louis.

Antimony.—The price tendency is still downward, with but little demand. We quote: Cookson's, 10½c to 11c; Hallett's, 9½c to 10c; ordinary brands, 8c to 8½c.

CHICAGO.

Dec. 4.

There has been a certain amount of routine buying in copper and lead during the week and some good inquiry for copper. Other metals were comparatively quiet and lead and spelter were off in price. Tin also was characterized by a weak tone. We quote:

Lake copper, 15c to 16c; casting, 14½c; pig tin, 34c to 34½c; spelter, 5.25c; pig lead, desilverized, 4.35c to 4.50c in 50-ton lots; corroding, 4.90c to 5c in 50-ton lots; car lots, 2¼c per 100 pounds higher; sheet zinc, 7c list, f. o. b. LaSalle, in car lots of 600-pound casks; Cookson's antimony, 12½c to 13c; other grades, 12c to 12½c.

Little interest in old metals was displayed during the week and prices sagged in sympathy with the market. We quote prices to dealers as follows:

Copper wire, 11¼c; heavy copper, 11¼c; light copper, 10¼c; heavy red brass, 10½c; heavy yellow brass, 8c; light brass, 6c; No. 1 red brass borings, 9c; No. 1 yellow brass borings, 7c; brass clippings, 8c; tea lead, 3c; lead scrap, 3¼c; zinc scrap, 3.05c; zinc clipping, 3c; tin foil, 21c; tin pipe, 25c; pewter, 16c; electrotype plates, free from wood, 4½c; electrotype dross, 2¼c; stereotype plate, 3c; stereotype dross, 3c; prime slab zinc dross, $65 per ton.

ST. LOUIS.

Dec. 2.

Lead and Zinc.—The closing down of more concentrating mills in the Joplin district Sunday night placed the output of ore at 50 per cent below the average production of the forepart of the year. Prices have also declined until the money now received for the sale of ore will not meet the expenses of mining, it is said, without prospect of a meager profit. In addition to this the wages have been cut to the low rate prevailing during the panicky times from 1891 to 1893.

While the high price during last week for zinc was up to $38, prices declined toward the end of the week to a $32 basis for 60 per cent zinc, and the only prospect offered for the present week is a further reduction in prices. The zinc smelters are "dead-firing" their furnaces and cutting out all that are in need of repairs, thus reducing the production of metal to a minimum.

HAS PROSPEROUS YEAR.

At the annual meeting of the stockholders of the Independent Pneumatic Tool Co., Chicago, held at Jersey City, N. J., the following directors were re-elected for the ensuing year:

James B. Brady, New York city; John P. Hopkins, Chicago; W. O. Jacquette, New York city; John D. Hurley, Chicago; James J. McCarthy, Chicago; John M. Glenn, Chicago; M. S. Rosenwald, Chicago; Simon Florsheim, Chicago; John R. Turner, Jersey City, N. J. At the annual meeting of the board of directors held at Chicago all of the present officers were re-elected for the ensuing year, as follows:

James B. Brady, president; W. O. Jacquette, first vice president; John D. Hurley, second vice president; A. B. Holmes, secretary and treasurer. The annual statement shows a very gratifying increase in business over the previous year. The company recently enlarged its plant at Aurora, Ill., installing a large amount of new machinery therein and now have facilities for practically doubling its output. The company is in excellent financial condition, and the outlook for business during the coming year is very promising. No cancellation of orders for Thor pneumatic tools are reported, nor has the company cancelled any orders for steel or machinery as it believes there will be considerable improvement in business during the forepart of next year after the financial flurry has subsided and confidence is restored.

The Saco & Pettee Machine Shops, Biddeford, Me., employing 1,400 hands, has laid off 90 men because of cancellation of orders.

BETTER FEELING

Due to Buying by Railroads Prevails in New York Machinery Market.

Office of THE IRON TRADE REVIEW,
Room 1005, No. 90 West St.,
New York, Dec. 3.

There is a slightly better feeling in the New York machine tool trade, due to more active buying by railroad interests, but in general lines there is still little activity and current business is confined chiefly to occasional orders for individual machines. The five cranes for installation at the Scranton shops of the Lackawanna railroad will be Shaws, furnished by Manning, Maxwell & Moore, Inc. No further tenders on equipment for these shops have been forthcoming. Tenders close this week on the most extensive list of railway equipment put out for some time, that for the Springfield and Brighton shops of the Boston & Albany.

Reports that the Japanese government or Japanese interests have put out inquiries for an extremely large number of lathes—one rumor having it 2,000—have been the occasion of wide interest during the past week. From all that can be learned, however, these reports are entirely without foundation. Export concerns know nothing of the rumor and even the selling concern reported to have taken the order is as much at sea over the matter as other interests. It is pointed out in this connection that the Japanese government placed orders in this country for about 10,000 lathes during the Russian war and is not likely to purchase other large quantities at present.

A Japanese project which promises considerable buying a little later is that of the Yoshinotani Mining Co., which is to install a large repair and manufacturing plant for the Karatsu Iron Works of Tokio. This will include a machine shop, foundry, boiler shop, power plant and accessories, for all of which equipment will be purchased in this country. It is also probable that steel for the buildings will also be secured here. T. Takeo, a Japanese engineer who is making his headquarters with the General Engineering Co., 90 West street, New York, is now engaged in designing the plant and securing information on tools and other equipment. He will not be ready to do any purchasing, however, until well in the next year.

E. Lang, formerly purchasing agent for the Wheeler Condenser & Engineering Co., New York, has taken service with the Universal Grate Bar Co., 95 Liberty street, as manager of sales.

AMONG NEW ENGLAND INDUSTRIES.

(Special Correspondence.)

Worcester, Mass., Dec. 2.—The Worcester Steel Foundry, Millbury, Mass., which has been rushed with orders for a year, has laid off most of the force, and business is practically at a standstill.

The Rutland Railroad Co., headquarters Rutland, Vt., is to equip its machine shops and car shops with electric power. Two 40-horsepower motors have been purchased, which will be installed in an addition built for the purpose.

F. E. Reed Co., makers of lathes, Worcester, has laid off comparatively few hands, and is working 59 hours per week.

The Reed Foundry Co., Worcester, is running almost full handed.

It is reported that the laying off of skilled machinists by some of the Worcester machine shops is helping the shops in Fitchburg, where a strike is on, and many of these idle men have been sent to Fitchburg for work.

The E. & T. Fairbanks Scale Co., St. Johnsbury, Vt., employing 1,300 men, which went on a 5-hour schedule two weeks ago, started Nov. 25 on an 8-hour basis. Orders for its goods are being well maintained.

Manufacturing concerns in and about Hartford, report no accumulation of stock, the tendency being to curtail production to the filling of orders, thus paving the way for prompt revival all along the line, when general conditions warrant. An improved tone in manufacturing is looked for within a few weeks.

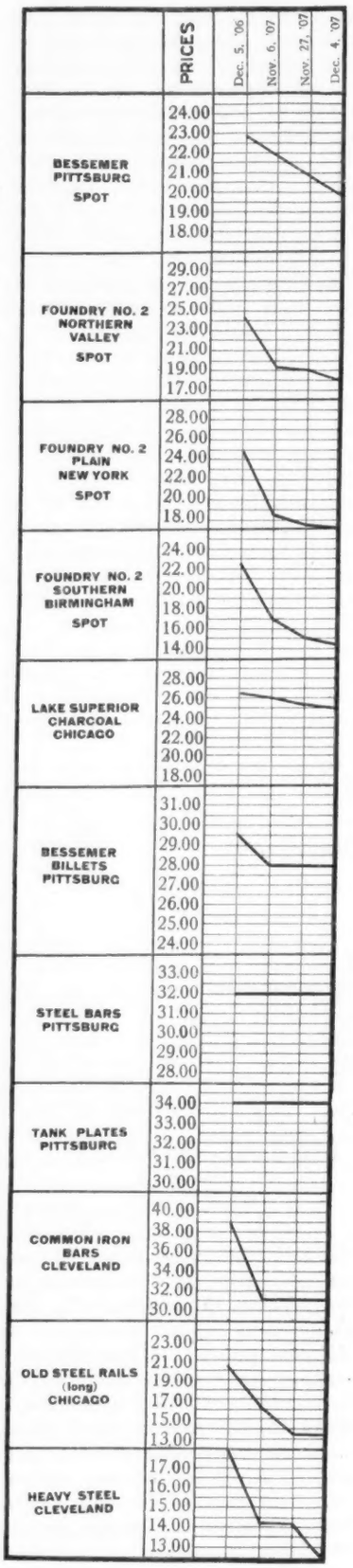
EMPLOYERS WILL ORGANIZE.

Buffalo, N. Y., Dec. 2.—A joint meeting and dinner will be held in this city, Dec. 12, under the auspices of the Buffalo Foundrymen's Association, the Buffalo Metal Trades Association, and the Buffalo Boiler Manufacturers' Association. The object of the meeting is to take up the question of forming here a general employers' association, the same as those in Chicago, Cincinnati, Detroit, Dayton and other cities.

The principal speakers on this occasion will be James A. Emery, secretary of the Citizens Industrial Association of America, of New York, and John J. Whirl, secretary of the Employers' Association of Detroit.

Robert Wuest, commissioner of the National Metal Trades Association, will sail from New York on Saturday, Dec. 7, for a Mediterranean trip.

PRICE CHART.



PERSONALS.

John C. McMynn has severed his connection with Robert W. Hunt & Co., Chicago, engineers, effective Dec. 1.

L. C. Parrott, formerly with the Jeffrey Mfg. Co., Columbus, O., has taken charge of the offices of the America Auto Brass Co., Columbus.

William W. Williams, of the Salem Iron Co., has been made superintendent of the Jackson Iron & Steel Co., Jackson, which is about to begin operation with a new furnace.

Wilbur F. S. Lake, general manager of the Buffalo Forge Co., Buffalo, N. Y., has terminated his relations with that concern. As yet Mr. Lake has made no definite plans for the future.

Powers Wick has been appointed superintendent of the lower mills of the Carnegie Steel Co., Youngstown, O., succeeding the late T. R. Smith. Mr. Wick has been in the employ of the company for several years.

C. W. Dyott has resigned his position with the Westinghouse Electric & Mfg. Co., and has opened an office in the Westinghouse building, Pittsburg, as engineer, making a specialty of electric motors and electrical operating mining machinery.

Charles M. Reese will shortly assume his new duties as general superintendent of the W. J. Oliver Mfg. Co., Knoxville, Tenn. He was formerly connected with the American Locomotive Co.'s works at Richmond, Va.

William Butterworth has been elected president of Deere & Co., Moline, Ill., succeeding the late Charles H. Deere. Mr. Butterworth is a son-in-law of the late head of the plant. W. H. Velie, nephew of Mr. Deere, has been chosen a vice president, and Burton F. Peek, a director and treasurer of the company.

L. C. Beecher, recently elected secretary and treasurer of the Tennessee Coal, Iron & Railroad Co., has been spending a few days in New York closing up a number of details before permanently assuming charge of his new position with headquarters at Birmingham. He was for a considerable time assistant to John A. Topping, chairman of the Tennessee and Republic companies.

Sumner Prescott, treasurer of the Prescott Co., of Menominee, Mich., was seriously and perhaps fatally injured in an automobile accident which occurred near Menominee, Dec. 1. With a party of three other men Mr. Prescott was driving the motor car along a road when the machine sudden swerved and went over an embankment, turning turtle and pinioning the men underneath.

Samuel A. Kennedy, president of the Rogers Brown Ore Co., has been appointed as one of the representatives of Illinois by Governor Dineen to attend the Inland Waterways Congress.

Chas. L. Rand, who has been in Cuba for the past three weeks in connection with the iron ore development work now being carried on by Pennsylvania steel interests, has returned to New York.

OBITUARIES.

Everett Bertram Webster, who was president of the National Steel & Wire Co., died suddenly Nov. 29 at the Windsor hotel, Jacksonville, Fla., a few minutes before his wife reached the city. He was a resident of Lynn, Mass.

P. C. Reed, assistant manager of the Alice blast furnace at Sharpsville, Pa., and the Ella furnace at West Middlesex, Pa., died Nov. 28 after an extended illness from rheumatism. Mr. Reed was well known in blast furnace circles in the Shenango valley.

Storm Bull, professor of steam engineering in the University of Wisconsin, died recently from cancer of the stomach, aged 51. He was graduated from the Federal Swiss Polytechnic Institute at Zurich, Switzerland, in 1877.

John Miller Wilson, president of the Wilson Steam Boiler Co., Omaha, Neb., died Nov. 23 at Los Angeles, Cal. Mr. Wilson prior to 1847 had built the boilers for the first ships of the Pacific Mail Co., the California, Oregon and Panama.

Luther D. Pollard, machinery manufacturer and dealer of Chicago, died Nov. 27 at his home. He was born in Brooklyn, N. Y., 62 years ago, and had been in Chicago since 1868. Mr. Pollard had built up a large business and was a prominent Mason.

George L. Jones, a well-known mechanical and hydraulic engineer, died Nov. 24 at Swissvale, Pa. Mr. Jones was in Swissvale attending the funeral of a relative when suddenly stricken. In the early days of Braddock he was one of the practical steel men added to the force by Captain W. R. Jones when he assumed charge of the Carnegie plants.

George H. Day, Hartford, Conn., connected with a number of industrial and financial enterprises, died Nov. 21 at the age of 59 years. He was at one time president of the Pope Mfg. Co., and later became connected with the Electric Vehicle Co., in the same capacity. He is survived by a widow and five children.

Samuel N. Ginsberg, founder of the firm of R. L. Ginsburg & Sons, Detroit, dealers in old material, died at his home in that city Nov. 22, at the age of 76. Mr. Ginsburg was born in Russia and came to this country 56 years ago. After making his residence for a number of years in New York, he settled in Detroit 32 years ago and established his business. He led an active commercial life until 1905 when he retired. He was father of Bernard Ginsburg, vice president of the R. L. Ginsburg Sons Co.

Arthur Edgar Sawers, chief engineer and second vice president of the A. Garrison Foundry Co., Pittsburg, died Nov. 19 at the age of 36. Mr. Sawers was born in England and came to this country with his parents when but 11 years of age. After receiving a common school education, he took a course in mechanical engineering in the Park Institute under the tutelage of George Mesta, of the Mesta Machine Co. Later he entered the employ of the Mesta company and became its chief engineer before resigning to become associated with the Garrison company.

John Irving Williams, a pioneer in the iron industry of the country, died at his home in Youngstown, O., Nov. 28, aged 83 years. He was born of English parentage at La Longe de Biegny, Department of Cher, France, and at an early age was brought to America by his family, which took up its residence at Boonton, N. J. His father being an iron man, Mr. Williams first turned his energies to that pursuit, and at the age of 13 began an apprenticeship in a rolling mill at Boonton. In 1838 the family moved to Pittsburg, where the father and son entered the employ of Lorenz & Cuddy, the young man later becoming superintendent of a rolling mill at Kittanning. In 1847 with his father and others, Mr. Williams purchased the mill and furnace at Hanging Rock, O., where he operated successfully until 1854, when he built the Scioto rolling mill at Portsmouth, O. Upon returning to the Pittsburg district in 1852, Mr. Williams took charge of the mills of Graff, Bennett & Co., at Millvale. Here he remained until 1877, when with H. M. Long and N. M. McDowell, he purchased the Keystone rolling mill at Hazelwood. In 1881 he went to Youngstown and took charge of the plant of the Brown-Bonnell Iron Co., becoming superintendent and continuing in that capacity until the consolidation with the Republic Iron & Steel Co. in 1899. Mr. Williams was prominent in banking circles and was an enthusiastic member of the Masonic order. He is survived by a widow, one daughter and two sons.

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BESSEMER AND OPEN-HEARTH.

For years the steel industry has confidently expected to see a fulfillment of the prediction made long ago that "The open-hearth process will go to the funeral of the Bessemer." Recent developments indicate rather clearly that the function will be a wedding instead of a funeral, a vastly more happy occurrence.

The duplex process is rapidly gaining in favor, and the details are being worked out in different ways by different metallurgists. It is more a matter of appliances and manipulation than processes, as the metallurgical work is laid out very clearly. The principle involved in the union is the same as that which contributed so largely to the happiness of the Sprat family, of nursery fame, since the Bessemer converter cannot devour phosphorus, while the open-hearth furnace finds it tedious to remove carbon and silicon.

The duplex process, however, carried out in mechanical detail, involves fundamentally the desiliconizing and partially decarburizing of blast furnace metal in an acid lined Bessemer vessel, and the subsequent removal of the phosphorus and otherwise bringing the metal to the proper analysis in the basic lined open-hearth furnace.

It does not follow that the plant, although composed of two distinct elements, involves a greater capital outlay in proportion to tonnage output, than does the more expensive of those elements, when used singly. By giving the open-hearth furnace only the work to do which it can do to the greatest advantage, the number of heats per day can be greatly increased. The converter, also, can operate on shorter cycles, and can be of greater capacity.

The blast furnace has hitherto been distinctly the servant of the steel mill. American practice developed the heavy outputs which made it famous years ago by establishing this subservience. The duplex process permits the use of higher silicons than would content the open-hearth furnace when used alone, and will enable blast furnaces to operate to better advantage in this regard, while, still more important, it furnishes a means of eliminating moderate quantities of phosphorus and removes the rapidly increasing burden of producing a large tonnage of pig iron under the Bessemer limit in phosphorus.

The duplex process would not be selected were the steel industry able to obtain in unlimited quantities any ores and coke it desired. Should it come into general use, its employment will have been due to the necessity of making the most of the minerals which are available. The process cannot be considered by itself; it must be taken in connection with the existing conditions, the blast furnaces which have been built and the minerals which nature has provided, having full regard to the values which commercial developments have written into these minerals. The requirements of the market must likewise be considered. The product of the duplex process includes the advantages rather than the disadvantages of the two separate processes.

OUR LARGE IRON ORE RESERVES.

It is very fitting that the United States Geological Survey should point out, in its forthcoming annual report, the absurd inaccuracy of the estimate of the available iron ores of the United States made a couple of years ago by a Swedish geologist to the Swedish parliament. The report was universally found fault with at the time by those in the United States able to form an opinion, but a condemnation which carries the weight of the Geological Survey's authority is a desirable addition. In making the criticism the Survey commits itself more distinctly than it has formerly, by reason of additional information obtained through late researches.

It will be recalled that the Swedish estimate credited the United States with but 1,100,000,000 tons of workable iron ore, out of total reserves of the whole world of 10,000,000,000 tons, thus giving this country but one-ninth of the total, and crediting it with nothing outside the Lake Superior region.

In substance, the Geological Survey now says that the Lake Superior region has between 1,500,000,000 and 2,000,000,000 tons, that above the 1,000-foot level Alabama, Georgia, Tennessee and Virginia have fully 2,500,000,000 tons of red and brown ores, that including also the red and brown ores of Maryland, West Virginia and Kentucky, the magnetic ores of other southern states, and also the ores below the 1,000-foot level, the southern states have probably 10,000,000,000 tons, and that "altogether it is probably safe to say that the United States has from 10 to 20 times" the quantity of 1,100,000,000 tons credited by the Swedish geologist.

The statements of the United States Geological Survey deserve confidence. The Survey, years ago, made the first serious estimate of the Lake Superior reserves, 500,000,000 tons for the Mesabi range and half as much for the other regions, and events soon proved the estimate to be a conservative one.

Its present estimate is less than some competent authorities have made for the Lake Superior region. Its forecasts for other districts will doubtless prove well within the mark, while there is considerable territory in the United States yet to be explored.

If the Swedish report is correct in its estimate of the reserves of the remainder of the world, the United States has as much iron ore within its borders as the rest of the world, and possibly twice as much. Be that as it may, the most conservative estimate must place the amount of iron represented by the ores known to exist in the United States as well in excess of 5,000,000,000 tons. That is enough to maintain the present rate of production for two centuries. It may be reasonable to assume that the previous rate of growth in demand for iron will be maintained for some time to come, but it is utterly unreasonable to assume that the demand can increase indefinitely, when one is speaking of billions of tons of ore and centuries of time. We are at present adding to our store of iron in use, rather than consuming it. Iron is required for the use of man, and the requirements must be represented by the product of the individual's need by the number of individuals. At 5,000,000,000 tons of iron available, there would be 50 tons per individual were our population increased to 100,000,000; our population may increase farther, but there is provided a pound of iron for every eight square feet of this country's area.

The conclusion is irresistible that the subject of the total extent of the iron ores is one which it is absolutely unnecessary to consider; the poorer of these ores have no value whatever; the value of other ores is merely relative, in that iron can be made from some of them more cheaply than it can be from others. As a corollary to this proposition, it may be observed that the commercial development of different ore bodies in the United States has not been in accordance with this rule; for instance, there is less reason to carry ore 1,000 miles over the surface to a point of consumption, as is now done with Lake Superior ores, than to carry it 1,000 feet through the earth's crust, a distance not yet necessary with southern ores, if the ores be of equal quality. A considerable part of the Lake Superior ores is inferior to some southern ores. The development of the future will gradually remove these irregularities.

INVISIBLE EXPENSE.

The inevitable result of false economy and a short-sighted policy is to render invisible many of the items which in the aggregate should make up the factory burden. These remain hidden, not so much because they cannot be revealed by a proper system, as because under the conditions such a system will never be put into effective use. Allowance may perhaps be made for the personal dislike of many a manager to having his failings too clearly displayed, but there is no excuse for the owner himself who should be free to seek the truth, and face it squarely.

And yet, generally speaking, it is more often the man with a direct financial interest, rather than his subordinates, who displays a tendency to save at the spigot while wasting at the bung-hole. It requires a broad mind and a staunch policy to consistently create visible expense, in order thereby to render visible and add thereto, other expense which it would be more comfortable for all concerned to keep hidden. Even under the best conditions, unnecessary expense lurks in every department; it permeates everything in the plant where no concerted effort is made to search it out. It is to be found not only within the items properly classed under indirect expense, but in a more subtle way it reduces the efficiency of the so-called productive workman.

With a penny-wise and pound-foolish method of buying both material and labor, with a strangely perverse failure to recognize the fact that the best is usually the cheapest, money is squandered while profits decrease. An apparent saving of 10 per cent in the cost of coal may in point of fact represent a loss, when measured in heat units per dollar spent. Cheap pattern lumber may be the most expensive when reduced to a basis of clear stock utilized for a given price paid. An up-to-date power plant may pay for itself in a few years out of the savings resulting from its substitution for an old style inefficient outfit. A clerk employed to do the work now scattered among, and poorly done by foremen and workmen, may show handsome profits on the expense incurred, although presenting in his own salary visible evidence of this increase.

If these statements possessed any novelty in form or fact, if it were not too evident that in many minds "ignorance is bliss," one might proceed to moralize further upon the importance of revealing the invisible in manufacturing expense. It might be shown how vital it is to every concern that the searchlight should be thrown upon every expenditure, and that some one of proper ability be delegated to conduct the search. It might in fact be proven that when the policy of revelation is intelligently adopted, and consistently kept within bounds, the profits on the investment would be phenomenal in the ordinary plant.

But so long as human nature controls, and such must always be the case, these conditions will exist. Happily, however, the view is broadening, manager and owner are proceeding to stop the hitherto invisible leaks, and to turn loss into profit. All along the line there is evident faith in the searchlight policy.

A Laudable Effort.—A very interesting example of the efforts now being made to restore confidence in the country is furnished in a letter which has been sent by President Heath, of the Heath & Milligan Mfg. Co., manufacturer of paints, Chicago, to its salesmen. After reviewing conditions at some length, President Heath says that, summarized, "we have on the one hand fear, lack of confidence, hysterical pessimism; on the other hand, abundant crops, abundant supply, abundant demand, abundant prosperity, with no confidence and optimism." He requests his salesmen to make the question of soliciting orders secondary entirely to an effort to restore confidence. "We would urge," he adds, "that you leave no town on your route without planting some seeds of confidence and optimism; plant those seeds in the hotels, on the cars, among your fellows, everywhere."

SOME IMPROVEMENT

In Cincinnati Machinery Market—Few Actual Shut Downs.

Office of THE IRON TRADE REVIEW,
First National Bank Bldg.,
Cincinnati, Dec. 2.

Some improvement in the general machinery situation in this market may be noted this week and the feeling is more encouraging for belief in continued betterment of conditions. Some orders have been received and a little scattering buying from railroads has helped to mitigate the general dullness. Collections, while still slow, are some better and as the financial situation improves, there is expectation of gradual awakening. A number of the shops have enough business on their books to keep them running practically full until the end of the year without making much stock.

In some of the shops working forces have been curtailed and shorter hours inaugurated, and some plants suspended operations the last half of Thanksgiving week, incident to the holiday. There have been practically no complete shut-downs of any of the large manufactures. Individual expressions from the leading machine tool manufacturers are remarkably hopeful in the face of current pessimistic talk in the business world. It appears that correspondence in the offices this week has been of a character calculated to encourage a more hopeful view of the outlook, but views as to when conditions are likely to become normal are not much in evidence, as the conditions are such as to discourage an effort at such a forecast.

The regular quarterly meeting of the Cincinnati branch of the National Metal Trades Association, which was to have been held at the Business Men's Club, preceded by the usual dinner on Saturday evening, Nov. 30, was postponed at the last moment owing to the receipt of a telegram advising that Charles P. Neill, commissioner of labor, had been unexpectedly called to Washington and could not be present to address the meeting as arranged. Considerable interest in Mr. Neill's presence at the meeting had been awakened and the committee deemed it advisable to postpone.

The Cincinnati Foundrymen's Association held a meeting on Nov. 29 to consider the propositions submitted by the machine tool manufacturers in reference to the differences between the machine tool manufacturers and the foundries in regard to contracts for castings. A committee was appointed by the foundrymen to prepare a report to be submitted to the machine tool builders, consisting of Theodore Bollmann, of the Bollmann-Wilson Foundry Co., L. B. Twachtman, of the Vulcan Foundry Co., Wm. Gilbert, of the Buckeye Foundry, and J. D. Leary, of the Queen City Foundry. This committee held a meeting on Saturday, Nov. 30. The report was not, however, completed, but is still in the hands of the committee.

The publication of the *Open Shop* issued by the National Metal Trades Association, beginning with the January issue, will appear in a reduced size adaptable for carrying in the pocket. It is also announced that beginning in the early part of 1908 the publication will carry a classified list of open-shop products in the metal trades.

INCREASED PROFITS

Shown by Republic Iron & Steel Co. in Past Four Months.

An interim report covering the operations for the past four months, together with comparative balance sheet, as of Oct. 31, 1907, has been issued by the directors of the Republic Iron & Steel Co. It is announced that such a report is made at this time because of the present financial situation. The income account from July 1 to Oct. 31, last, with comparisons over the preceding year, is as follows:

	1907.	Changes.	
Net earnings after maint. and rep...	$1,942,143	Inc.	$ 715,647
Other income	45,655	Dec.	29,728
Total profits.....	$1,987,789	Inc.	$ 685,919
Int. on bonds col., treas. notes, etc..	334,770	Dec.	36,402
Net earnings	$1,653,028	Inc.	$ 722,321
Div. pfd. stock, Oct. 1	357,396	Dec.	408,338
Net addition to surplus	$1,295,732	Inc.	$1,130,659

Analyzing the balance sheet, Chairman John A. Topping says in part:

"Your general inventory of materials and supplies shows some increase since July, due to the fact that it is necessary to bring down during the season of navigation, prior to the winter months, the annual supply of iron ore. This large tonnage involved a substantial increase in your inventory total. Aside from this item, the general stocks of other materials and supplies are light, and the values at which these stocks are carried on your books are at or below present market values, and even in the event of any reduction in market values, your shrinkage account cannot be an important item.

"The amount carried in accounts and bills receivable is large, due to recent trade activity, and influenced somewhat by the deferred payments of customers, caused by existing conditions. The total amount of doubtful accounts is small, and your guarantee fund is more than ample to take up any probable losses. Your November collections, under existing conditions, have been surprisingly large, cash collections having aggregated approximately 66 2/3 per cent of your normal receipts.

"The physical condition of your property was never as strong as it is today, and your property was never as nearly self-contained, both with respect to its ownership of minerals and its production of raw materials required in its manufacturing department. The productive capacity of the property has been strengthened, the gains in production, as compared to the four months from July 1 to Oct. 31, 1905, being as follows: Pig iron increased 80 per cent, Bessemer steel increased 12½ per cent, and finished products increased 10 per cent.

"Under the stimulus of greater production the earning power of the property has naturally increased. The result for the month of October, 1907, both in respect to volume of business, tons produced, and net profits realized, having established a record in excess of that for any preceding month in the history of the company.

"Your unfilled orders on hand as of Nov. 25 aggregate 231,280 net tons of finished and semi-finished material, which, as compared to the tonnage on hand for a similar period of about 25 per cent. The volume of business on hand and received during the month of November to date warranted the operation of about 50 per cent of your present manufacturing capacity. No stocks are being accumulated, production being limited strictly to current trade requirements."

VERY LITTLE CHANGE

Is Noticed in Central Pennsylvania—No New Companies Chartered.

(Special Correspondence.)

Harrisburg, Dec. 3.—Conditions here have not changed for the better to any extent. The Middletown car works has started on an order for cars for the Philadelphia & Reading Railway Co. and will run for some time. The Penn Iron Works at Lancaster also ran last week after a ssupension.

The blowing out of furnaces continues and there is a report that several others in this section of the state will suspend. The Pennsylvania Steel Co. shut down one of its North Lebanon furnaces, but has one working. But three furnaces in Lebanon county are now running. The same steel company is running four furnaces in this county and last week only its Bessemer department was idle.

At Reading the Reading Iron Co. stopped work in several departments, but it is understood that it is but temporary. Another event of interest at Reading was the naming of John L. Coxe, of that city, as receiver of the Keystone Wagon Works, a large concern. It has over $50,000 in collectible bills.

The Thomas Iron Co. is reported as repairing furnaces which were recently stopped.

Last week for the first time in months no new charters were granted by the state. Few increases of stock were filed. There are a number of applications pending, however.

HOLMAN IS PRESIDENT

Of the American Society of Mechanical Engineers—Foundrymen Attend.

(Special Telegram.)

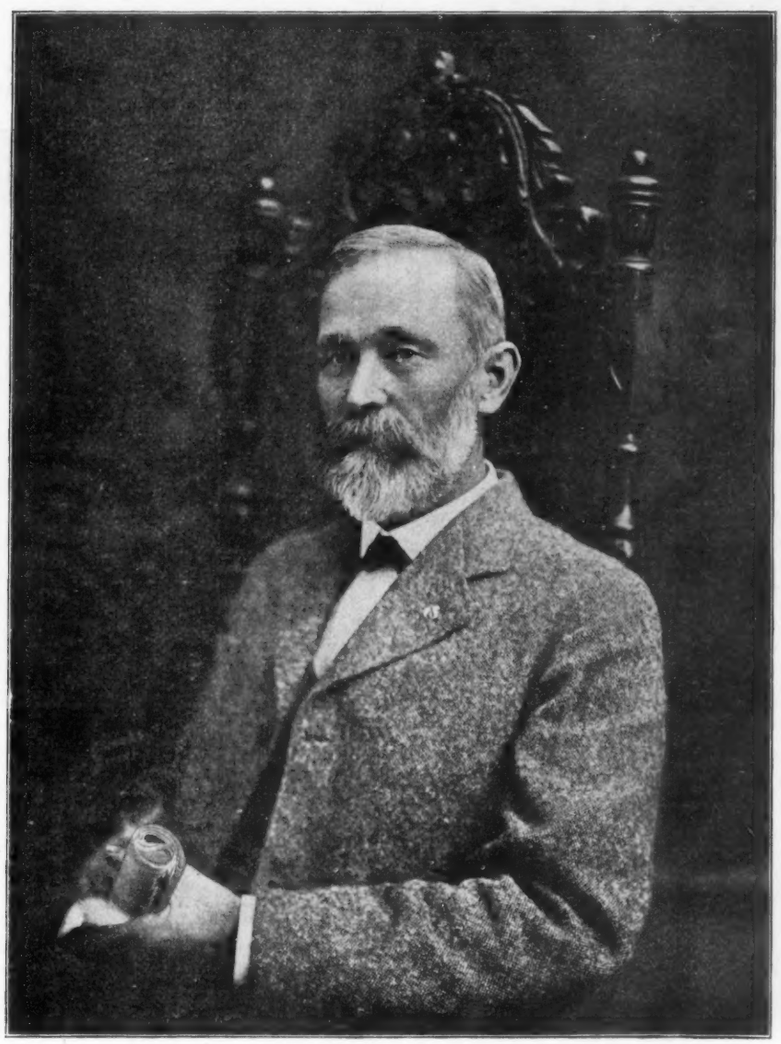
New York, Dec. 3.—The opening session of the 28th annual meeting of the American Society of Mechanical Engineers held in the main auditorium of the United Engineering building this evening, was attended by a large and distinguished gathering.

"The Mechanical Engineer and the Function of the Engineering Society" were ably discussed by Prof. F. R. Hutton in his presidential address and suggestions for a further extension of the usefulness of the society by the organization of locals evoked great enthusiasm.

The report of the tellers, presented after the delivery of the president's address, showed a total vote of 1,249 and the election of the following officers: M. L. Holman, president; Prof. L. P. Breckenridge, Fred J. Miller and Arthur West, vice presidents; W. L. Abbott, A. C. Humphreys and H. S. Stolt, managers.

Mr. Holman was escorted to the rostrum by Ex-president John Fritz and John E. Sweet, two of the venerable members of the society. He was introduced to the members by President Hutton and was given an ovation. He thanked his fellow members for the honor conferred upon him, but declined to make any extended remarks in view of the fact that he would have an opportunity of doing so at the end of his term. A buffet lunch was served after the meeting.

The registry already shows an enrolment of over 700, many foundry engineers and superintendents being present. At later sessions, much attention will be given to foundry topics.



MINARD LEFEVRE HOLMAN.

The New President.

Minard Lefever Holman, the newly elected president of the American Society of Mechanical Engineers, was born in Maine in 1852. His father was Col. Holman, of the United States supervising architect's department. The family moved from Maine to St. Louis in 1860 and Mr. Holman has lived in that city ever since. He graduated from the Washington University of St. Louis in 1874 with the degree of civil engineer, and that institution has since conferred on him the honorary degree of master of arts.

He was for some years after his graduation connected with the supervising architect's department, leaving that position to connect himself with the St. Louis water department, under the late Thomas J. Whitman. After several years as principal assistant engineer under Mr. Whitman, he was in 1887 appointed water commissioner of the city of St. Louis, which office he held for three terms, or 12 years in all. Under his supervision the St. Louis water works was almost entirely rebuilt and experiments inaugurated which resulted in the satisfactory clarification of the Mississippi river water.

Leaving the water department, he was for over four years the general superintendent of the Missouri Edison Electric Co., and for the last four years has devoted his entire time to consulting work, having formed a partnership with John A. Laird, member of the American Society of Mechanical Engineers, under the firm name of Holman & Laird. He has made a specialty of water works and power plants and has served on some very important commissions, notably a commission to design new water works system for the city of Omaha, of which he was the chairman. He is now a member of the commission for appraising the property of the Denver Water Co., representing the city of Denver on the commission. He is a member of the American Society Consulting Engineers, American Institute of Electrical Engineers, St. Louis Academy of Science, and an honorary member of the American Water Works Association.

Recommends Foundry. — A new foundry for the naval gun factory at the Washington navy yard is urged in the annual report of Rear Admiral Hollyday, chief of the bureau of yards and docks, A plant to cost $300,000, of which $100,000 is to be appropriated for immediate use, is recommended.

PIG IRON OUTPUT SHOWS BIG LOSS.

The marked extent to which curtailment of output has proceeded is shown by the production of pig iron in the United States in the month of November. The total output of the country reached 1,815,224 tons, compared with 2,359,690 tons in October, a decrease of 544,466 tons, and against 2,174,148 tons in September, a month of equal length. The greater portion of the decreased output is shown among the non-merchant companies or those employing their own make of iron in manufacturing, in which class, a loss of 430,414 tons over October is shown. This has resulted from the closing of many plants operating upon finished lines. The total number of furnaces in blast in the country on Dec. 1 was 227, against 315 in blast on Nov. 1, a decrease of 87 stacks. As indicated by the average daily capacity in blast the last day of the month, December begins its producing period with a greatly decreased capacity in blast, the daily capacity for Nov. 30 being 50,966 tons, compared 72,224 tons on the last day of October.

Rapidly Blowing Out.

The blowing out of stacks still continues, a number having stopped operating since the close of November. Among these may be mentioned two furnaces of the National Tube Co. at Lorain, O., the entire furnace plant there now being shut down; the two Riverside furnaces of the same company; the stack of the Thomas Furnace Co., Milwaukee; Top furnace of the Wheeling Steel & Iron Co., Wheeling; "A" stack of the Toledo furnace; one of the Lebanon stacks of the Pennsylvania Steel Co.; one of the La Belle stacks; the stack of the Bird Iron Co., Ironton, O.; one of the stacks of the Ashland Iron Mining Co., Ashland, Ky. The Princess Furnace Co. expects to blow out Princess furnace early in the month, probably about the 5th or 6th.

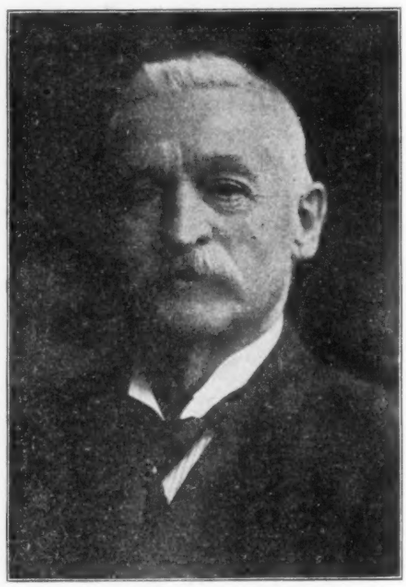
The furnaces which went out during the month include three of the Sloss-Sheffield Steel & Iron Co. at Birmingham; nine of the Illinois Steel Co., at its various works, which were blown out on dates ranging from the 2d to the 17th of the month; B furnace of the Maryland Steel Co. blown out on Nov. 21; No. 2 Wharton furnace, Wharton, N. J.; one of the furnaces of the Buffalo & Susquehanna Iron Co.; Franklin furnace, Franklin Springs, N. Y., blown out Nov. 21; Belfonte furnace of the Belfonte Iron Co., banked Nov. 26; the active furnace of the Allentown Rolling Mill Co., Allentown, Pa., blown out Nov. 4; the Paxton furnace of the Central Iron & Steel Co., blown out Nov. 4; Marshall furnace of the Juniata Furnace & Foundry Co., blown out Nov. 20; No. 1 Hazelton furnace of the Republic Iron & Steel Co. blown out Nov. 5 and one of the Pioneer furnaces of the same company blown out Nov. 2; No. 3 furnace of the Shenango Furnace Co., Pittsburg, blown out Nov. 27.

NOVEMBER FURNACE REPORT.

STATE—	NO. OF STACKS	NO. IN BLAST ON LAST DAY OF MONTH		PERCENTAGE OF TOTAL POSSIBLE OUTPUT MADE	AV. DAILY CAPACITY IN BLAST LAST DAY OF MONTH	ACTUAL TONNAGE MADE		TOTALS	
		NOV.	OCT.			MERCHANT	NON-MERCHANT	NOV.	OCT.
Pennsylvania	157	96	127	69.2	24,067	209,259	593,692	802,951	1,020,928
Ohio	61	32	54	73.2	8,608	160,552	190,030	350,582	495,828
Alabama	46	20	29	54.1	3,378	102,486	23,670	126,156	151,815
Virginia	22	14	13	63.6	1,197	35,678	———	35,678	36,940
New York	24	12	18	61.0	3,042	59,618	50,195	109,813	151,593
New Jersey	10	5	6	55.0	732	24,156	———	24,156	29,576
Illinois	24	16	24	80.0	5,373	20,310	163,554	183,864	224,907
Tennessee	18	12	14						
West Virginia	4	2	4	70.1	1,751	37,529	22,001	59,530	78,997
Kentucky	7	4	4						
Maryland			3	4					
Wisconsin	6	3	5						
Colorado	6	3	5	70.3	2,392	11,658	72,533	84,191	109,691
Indiana	1	1	1						
Georgia	2	0	1						
Texas	2	0	1						
Minnesota	1	1	1	63.8	426	15,844	———	15,844	21,514
Michigan	2	2	2						
Missouri	1	1	1						
Spiegel—All states								15,139	28,686
Ferro—All states								7,320	9,668
Totals	398	227	314	———	50,966	677,090	1,115,675	1,815,224	2,359,690

DEATH OF COL. CHAS. A. McNAIR.

Colonel Charles A. McNair, veteran ironmaster of St. Louis, died at his residence, 4244 McPherson avenue, Nov. 28, aged 76. He was born in Pennsylvania and went to Howard county, Mo., with his parents when he was eight years old. He removed to St. Louis 41 years ago. At the time of his death, he was president of the St. Lou's Blast Furnace Co., formerly the Pioneer Furnace Co., and later the Missouri Furnace Co. His closest friend and business associate was Alexander P. DeCamp, president of the DeCamp Bros. & Yule Iron, Coal & Coke Co., and a partner in the furnace business. Colonel McNair is survived by two children, Edwin and Louise McNair.



CHAS. A. McNAIR.

The annual meeting of the American Society of Civil Engineers which by constitutional provision is held on the third Wednesday in January, is announced for Jan. 15-16 next. The first day will be devoted to business purposes and the following day to excursion and social features. No technical papers are presented at the annual meeting, but there will be general discussion on the report of the special rail committee, which was made at the Mexican meeting but was not discussed at that gathering. The report of this committee was published in full in the August number of the society's journal.

THE MECHANICAL ENGINEER AND THE ENGINEERING SOCIETY.[1]

BY F. R. HUTTON.

In turning to the historical definition of engineering or that which has its authority from long usage, the stately language of Tredgold of England always claims first place as of right. Mr. Tredgold's historic definition is: "Civil engineering is the art of directing the great sources of power in nature for the use and convenience of man." He amplifies this by adding that it is a practical application of the most important principles of natural law, and has among its objects that of improving the means of production and of traffic for external and internal trade, such application being directed to the construction and management of roads, bridges, railroads, aqueducts, canals, river navigation, docks and store houses, ports, harbors, breakwaters, moles and lighthouses. He includes also the protection of property from injury by natural forces, as in the defense of tracts of land from encroachments by sea or rivers; the direction of streams and rivers for use either as powers to work machines or as supplies for towns or for irrigation, as well as the removal of noxious accumulations as by drainage. He touches also upon navigation by artificial power for the purposes of commerce, and adds that the scope of utility of engineering will be increased with every discovery in natural law and physics, and its resources with every invention in mechanical and chemical art.

In comment upon this definition it may be observed that it should be regarded as a definition of engineering in its broad and comprehensive sense, and should not be used to apply only to that specialized department of the profession to which in America the term civil engineering is applied in education and in popular use; Mr. Tredgold meant engineering as practiced by the civilian in contradistinction to that practiced by the military engineer.

In addition it should be noted that this definition of engineering as practiced by the civilian was given in the infancy or at the birth of the modern industrial epoch in which we are now living. The year 1827 was two years in advance of the competition at Rainhill where Stephenson solved the motive power problem of the railway. The machine tool was still a small thing, whose tools were held by hand to the work to be done. The mining of England while important relatively was yet limited for lack of shaft-machinery. Faraday had yet four years to labor before he made his historic discovery of the induced electric current. The metallurgist and chemical engineer could only come into being when the needs of a community, built upon industrial production with cheap power at its base, should have called for him. Nasmyth with the steam hammer and the large machine tool were still in the future; but most of all and most significant of all from the present point of view, the idea of manufacturing or production upon a large scale, in factories or shops where groups of productive machinery were gathered together to be served by a common source of mechanical power had not yet been born.

Again, it is only by a great stretching of the inclusive character of terms, that the expression "powers of nature" can be made to include the forces which are economic or social or psychological in their application, and which come into play for control and direction when production on a large scale is under consideration, and large numbers of human beings become the organs or implements of the factory as a tool for production. Such energies directed and controlled by an engineer may only be included within the "powers of nature" by an effort which strains their meaning to the breaking point in unfriendly hands; he is yet a director or controller of forces, and of no insignificant type.

The inclusion of the powers of nature within the scope of the elements of the profession of engineering carries with it the utilizing of the resisting forces created in the materials of engineering when such powers are exerted to deform them.

Finally, he who commits himself to the splendid Tredgold definition must take its alleged defect with its excellency. It is that it includes as engineers not alone those who create and install apparatus to control and use the powers of nature, but those also who direct and control the machines or apparatus when created and installed. This will include those whom I will call "co-ordinators of design," who take the various apparatus on the market, and combine them into a whole. Somewhat under the same category is he who receives the finished power house with all its units from the foregoing type of engineer and his allies, the contractors who have done the construction work, and is then and thereafter entrusted with this upkeep, repair and continuous operation.

If the writer may modestly put forward a suggestion for a revision of the historic definition, he would word it: "The engineer is he who by science and by art so adapts and applies the physical properties of matter and so controls and directs the forces which act through them as to serve the use and convenience of man, and to advance his economic and material welfare."

This leads up naturally to the differentiation of the mechanical engineer from those versed and skilled no other branches. There are at least 13:

The mining engineer and his close ally the metallurgical engineer is concerned with the discovery and the extraction from the earth of oil, fuel and rock to the working point. The metallurgical engineer who transforms the crude ore into marketable metal or into the merchant form or structural shape is allied to the chemist upon the one side, to the mechanical engineer upon the other. The mining engineer may be both miner and metallurgist.

The electrical engineer is primarily entrusted with the transformation of mechanical or chemical energy into electric form, and its transmission in that form to the point of use, where it will be again converted into some other shape.

The naval engineer and marine architect is a specialized mechanical and structural engineer. His hull is a truss unsymmetrically loaded and variably supported; his motive power a definite yet widely diversified problem.

The military engineer must cover both the defensive and the offensive department of his avocation. On the one side he is a structural engineer.

[1]Abstract of the presidential address given at the New York (December, 1907) meeting of the American Society of Mechanical Engineers.

On the side of attack, the problems of ordnance both for its construction and for its operation take him into the field of the mechanical engineer and electrical engineer.

The chemical engineer is in charge of production or manufacture where the process or the product, or both are chiefly or entirely dependent upon the theories and practice of chemistry.

The sanitary engineer is a specialist in hydraulic engineering in the applications of water supply and drainage as means to secure the well being of the community as respects its public health.

The heating and ventilating engineers, making a specialty of the sanitary requirements of enclosed houses as respects their fresh and tempered air supply.

The refrigerating engineer is concerned with the transformation of mechanical or heat energy so as to lower the amount of such intrinsic energy in any material or space.

The hydraulic engineer is of two groups. The one type concerned with the problems of the river or canal for navigation or for power with the dam is a civil engineer. The other type, concerned with the water motor and its attached machinery for its operation; with the mechanical handling of water for city use on for power in industry, the designer of pumps and hydraulic utilization machinery is a mechanical engineer.

The gas engineer has two sets of problems. The one is the intra-mural manufacture and storage of his product, where his functions are those of the chemical manufacturer, and he should be both chemical and mechanical engineer; the other is the distribution problem.

There is no recognized group of engineers of transportation. Such a group obviously exists, however. Such are the engineers of motive power on the steam railways, with the master mechanics and the signal engineers and the operative class on locomotives; such are the street railway engineers; the car builders; the maintenance of way engineers, the bridge engineers, the engineers of floating equipment.

The foregoing grouping does not claim to be exhaustive nor inclusive of all subdivisions of engineers even so far as it has gone. But the purpose has been to clear the way for the separation of the two most closely allied in function and service, the civil and the mechanical engineer.

To the mechanical engineer belong as undoubtedly, and as of right the problems of the generation of power in power houses and power plants, and its transmission to the operative point unless this latter is done by electric means. It is also plain that to the mechanical engineer belong all creative design and manufacture of tools and machinery. This makes him therefore the natural administrator or executive of the production processes involving the use of machinery in factories and mills, and it is here that he finds his broadest scope and widest opportunity. As creator of machinery he will be a draftsman or designer of a producing plant; an operator of the plant considered as a tool for production, he will be a general manager or superintendent, or will perform these functions as owner or as president, vice president, agent, secretary or treasurer. As a producer of power the railways make the mechanical engineer their superintendent of motive power, and the rail and joint become also responsibilities of his; as administrator of men and machinery, he becomes master mechanic of the railway.

But this relation of engineer of production borne by the mechanical engineer is at the bottom of very notable developments of progress. As the scale of production increases with the aggregation of capital invested, the permanence of the business becomes inseparably bound up with the satisfactory quality of its output. Hence there grows up a system of business in which the reputation of the producer becomes a factor compeling him to satisfy the buyer as respects the engineering excellence of his purchase; and it becomes possible for the contract between the two to be based upon the specifications created by the producer or seller, and not by the engineer of the buyer. The engineer of production is called on to originate his specifications and to enforce them in production, in order that the guarantee of quality and of economy in use may both be satisfactory to the user.

This economic condition also has given rise to a group of engineers properly mechanical, who are directly and productively related to the producing corporations as their representatives in their selling organization over a large territory. It is their duty to act exactly as the co-ordinator of design does in his office, and secure for the intending purchaser an engineering solution for his needs which shall be satisfactory to him. The mere salesman could not perform the duty of the case, unless the buyer were protected by a consulting engineer.

And finally, the group of engineers of production must include the industrial engineers who are organizers of men or departments or works as tools of production. These men are not creators of visible machines embodied in steel or iron, which perform material functions, but are creators of power and director of forces under the fundamental definition.

The final criterion or touch-stone for all these claims for the scope and function of the mechanical engineer must be the answer and attitude of the profession itself. The American Society of Mechanical Engineers exists to promote the arts and sciences connected with engineering and mechanical construction. The member must be competent to take responsible charge of work in his branch of engineering as designer or constructor, or he must have served as a teacher of engineering.

Who are these members, and what are they doing? The grouping for the purpose in hand has been into the following classes:

Group Name.	Numbers.	Percentage.		
The unclassified	306	10.3		
The army and navy	11	0.4		
The marine	18	0.6		
The hydraulic	12	0.4		
Patents	25	0.8		
Journalists	30	1.0		
Mining and metallurgy	30	1.0		
Engineering contractor	48	1.6		
Testing and inspecting	49	1.6		
Operating engineer	55	1.8		
Locomotive and railway	57	1.9		
Electrical engineer	65	2.2		
Professor and teacher	185	6.3		
Draftsman and designer	115	4.0		
Local manager	153	5.2		
Shop executive	338	1572	11.8	53.6
The manufacturer	966	32.6		
Office practitioner	493	16.5		
Total	2957	100.0		

There would seem therefore a good ground for defending a twentieth century Tredgold who should define or describe the mechanical engineer of his period: "The mechanical engineer is one who by science and by art so adapts and applies the physical properties of matter and so controls the forces which act through them as to serve the use and convenience of man and to advance his economic and material welfare. He does this mainly by storing and liberating motor energy through machines and apparatus which he designs and installs and operates for the purpose of fostering and developing the processes of industrial production which use and require such power upon a large scale."

The foregoing discussion draws after it as in its wake a group of other interesting questions. Among these for example, is the historical one, as to how the engineer came to be the

central figure which he is today. In the earliest times the patriarch was the central figure; later, the war lord was king; he in turn gave way to monkish priest as supreme center, and after a recrudescence of the warrior we are now scheming policies to secure peace which shall enable the production engineer to do his best work and with the least waste. As early as the legend of King Solomon is the claim of the tool maker, and the mechanical engineer of today is the heir of the functions of the tool maker on the largest scale. Again, the educational significance of the definition is most important. We have derived our standards in the technical schools from the requirements of the historic military academy at West Point. This in turn inherited the policies and practice of th European governmental schools for engineers. We have borrowed also from France and Germany directly. Very close to the heart of such standards lies the devotion to the highest mathematics both as a discipline for the mind and character, and as a means of separating the qualified and the assiduous from the incompetent and lazy.

What can or may the engineering society made up of mechanical engineers, as above, do for the profession? What are its duties and functions? It is plain that these are in two directions; its service to the members within it, its duty to those outside of it.

Taking up the service to the members within it, the society first serves by its existence. The fact that there is such a body at all is a token of its strength. For it means that there are three thousand men and over, who with all their diversities have yet a common dependence upon law and principle, and who are pursuing a common aim.

Another function or service of the society is the offering of the right of association. By this is meant more than the opportunity of social intercourse at meetings, but the privilege of association in the larger sense. It is a great thing for a man to feel that his name appears upon a list which has been signalized by the names of John Ericssen and Chas. H. Haswell, and still bears those of John Fritz, Rear-Admiral Melville, Thomas Edison and Chas. T. Porter, John E. Sweet and George Westinghouse.

A function of the society is that of providing meetings of its members at proper intervals during the year. An ideal meeting would be one in which at least three elements were combined in wise proportions. The first is a mental stimulus in the form of live topics of professional interest presented as papers or otherwise; the second is the opportunity for social or intellectual attrition with other minds and temperaments during an association or intercourse lasting long enough for acquaintance to ripen; the third is a mental and physical stimulus and relaxation of tension by a sight-seeing which shall not be interesting only for the empty minded or the uninformed.

The meetings of the society are one of its principal opportunities whereby the society as such reaches and impresses the general public in the cities where it meets. The professional sessions do not wield a very great influence in this respect; but the other features of the meeting do. Hence it has been felt to be of the first importance that in all its outward relations the professional and scientific sides of its purpose should be strongly emphasized, rather than its contact with commercial problems. If the commercial instinct for business were once allowed a foothold, the meetings would become the arena of industrial and commercial rivalry, and their high character would disappear.

So long as the members, council and membership committee are sensitive to the duty respecting the quality of the applicants for membership, it will follow that the fact of membership in the society is a stamp of quality of engineering achievement. This stamp of approval upon every enrolled member is a very precious possession.

Another function of the society is its creation and maintenance of a library. In recent times the enormous increase in the number of books required for any library with a pretense to completeness; the necessity for rapid expansion if it was to keep pace with the progress of the day; the investment required in society memberships to secure their publications, and the bulk of current periodical literature of the profession make the housing and the care of a worthy private library impractical for the individual. Hence the opportunity arose for the society library, doing for all the members what each could do for himself only with the greatest difficulty or prohibitive expense.

The foregoing services rendered by the society to its members are all in an imponderable class, and do not have a value which is appraisable in legal tender. The non-member cannot buy them, however wealthy he may be. This makes them therefore of all the functions of the society the six which are the most to be prized. There comes next the privilege of the publications.

The publications at present include only material originating in the membership for presentation at meetings. It has been felt for some time that these were unnecessary and undesirable limitations to place upon the possibilities of usefulness of the publications. They would be of incalculably greater value and use if they could be made to include abstracts of papers before other professional societies than our own; reviews of contributions to technical journalism, book reviews and contributed material by non-members on current achievements, new work, and live topics.

Is the privilege of service and of function all on one side, or has the society the right to ask from its members a reciprocal duty to itself? The latter, no doubt. It is the duty of the individual member and his privilege to make at least the following effort: That no fancied advancement of his personal interests by a member should lead to any act or practice which will stain his character and injure his fair fame. The individual member should seek to build up the society in professional and numerical strength.

Consideration must now pass to the final topic under review, which is the possible function of the society to the profession who are not enrolled in its membership. If the foregoing argument has been conclusive, it is plain that such service or functions should be discharged without a prejudice to the interests of the membersip itself. There are two extremes of view and opinion. The one is the aristocratic idea, that the society exists exclusively for the advantage of the members. The other extreme is that all adherents or practitioners of engineering are equally eligible, regardless of professional achievement or training. All draw equally from the common fund of professional advantage from membership; but of course there are no private fortunes of distinguished advantage, and no one draws as much in the larger community from an equal fund as he does in the former case.

A membership which is ill-assorted and non-homogeneous will not be a strong one regarded as a unit. The differences in education, in extent and quality of experience in culture and social equality as the former factors affect this, would seriously interfere with the success and unity of the meetings.

CONDITIONS IN THE INDUSTRIAL WORLD

General Belief That the Depression Will Not be Prolonged—Further Curtailment of Production Expected, but Some Plants Are Resuming.

Since the recent stringency in the money market set in, a large amount of inaccurate news has been published; in some cases, such as in the wholly unfounded report that the Pennsylvania railroad had cancelled orders for 450 locomotives, conditions have been made much worse than they really are, while on the other hand some incorrect statements in regard to resumption of manufacturing plants have been widely published. While it is our belief that fundamental conditions in this country are sound and that every one ought to do his utmost to assist in restoring confidence, we do not believe that better conditions can be permanently established by publishing rosy reports which are not justified by the facts. We have accordingly instructed our correspondents to obtain from time to time all the accurate information available in regard to iron and steel plants. Our reports indicate that while there has been a sharp curtailment of production and many more plants will undoubtedly be closed or decrease output for a time, there is a very hopeful feeling prevailing throughout the country, and the belief is general that the period of depression will not be greatly prolonged. The following reports give the facts as ascertained by our correspondents.

FOREIGN ORDERS HELP

In the Machine Tool Business in New England—The Bank Situation.

(Special Correspondence.)

Worcester, Mass., Nov. 28.—The situation here among the machinery manufacturers, because of the scarcity of money, is somewhat complex, but on the whole not so seriously affected, perhaps, as in some other localities.

One manufacturer of machine tools reports running 35 hours per week, and but two-thirds of full force. He thinks that while business may revive to some extent by spring, it will not be until the fore part of 1909 that business will resume its fullest swing. The views of this manufacturer are about as conservative as any in this locality. Another prominent tool builder has let very few men go and is running 59 hours per week. Still another tool making concern has just started on eight hours per day. In fact, a number of concerns have taken similar methods to keep their working force intact, yet enabling them to conform to restricted business.

Still another machinery maker reports having let no men go at all, but has hired a few men of late, and while suffering the loss of a few orders by cancelation, yet has sufficient good orders now in hand, which it is not expected will be canceled, to keep his plant going in full force until next March.

In about every instance the foreign orders hold up without diminution, thus helping, in a measure, to offset the slowing up of home orders. A sound element in the situation is, of course, that there is no stocking up as yet, no overproduction. Manufacturers are trimming their sails, or have trimmed them, to meet the situation, and while maybe not exactly glad there is a slowing up, are not sorry, as the pace heretofore has been too rapid.

The banks of Worcester have not acutely felt the lack of cash, but collections from distant points by the manufacturers have been slow in some cases.

REDUCED FORCES

In Many Plants at Ohio's Capital—Pennsylvania Company Curtails.

(Special Correspondence.)

Columbus, O., Nov. 30.—Although but one plant has shut down entirely, and one private bank closed its doors, in Columbus, owing to the recent financial disturbances, all of the industries of that city have felt the depression in business and have reduced their forces, shortened their work days and in other ways taken steps to retrench in operating expenses.

The plant that shut down is the Columbus branch of the Carnegie Steel Co. This plant is used by the company as a reserve and is naturally the first to be closed down in case of a depression in business. The officials of the local plant have everything in readiness to resume operation when orders come to do so, but they have no information that would indicate that the plant will be opened in a week, a month or a year.

An official of the Pennsylvania lines said that a reduction of practically 12½ per cent of the normal expense of operating the big shops of the company in Columbus is being made. This is done by reducing the hours of work per week and reducing the forces in various departments. For instance, the company has enough cars in service to handle the present volume of business and it consequently has reduced the force in the car-repair department to the minimum. The shops of the Hocking Valley and Ohio Central in Columbus and elsewhere are suffering a like reduction in working hours and men.

Frank Eaton, treasurer of the Kilbourne & Jacobs Mfg. Co., said that while the company's domestic trade is considerably affected by the present business depression, the activity in the export trade in a measure offsets it. This is particularly true in the steel car department. The company has closed down three of its departments for repairs and improvements, shortened its working days, and reduced its force considerably below the normal force for this time of the year. Work in the departments that closed has been resumed with a limited force.

Robert H. Jeffrey, of the Jeffrey Mfg. Co., says the business of his company has fallen off to a considerable extent as a result of the financial disturbances and the resulting depression in business generally. Although none of the departments of the Jeffrey plant are closed down altogether, the working week has been reduced and the force is cut down about 25 per cent of its normal.

S. P. Bush, general manager of the Buckeye Steel Castings Co., says the present conditions have had a decidedly quieting effect on the business of his company. Besides shortening the working days, the working force of the plant has been reduced between 35 and 40 per cent of its normal strength. This is usually the company's busy season.

The Ralston Steel Car Co. was among the first of the Columbus plants to feel the general depression in business and several weeks ago it practically cut its force in two by discontinuing the night shift.

The same reports are received from the smaller plants of the city. They are all operating on short working forces and short working days with the exception of the structural steel plants. This is naturally the quiet

season for them and they are operating with their normal winter forces.

A representative of C. E. Morris & Co., manufacturers of structural steel, said: "We are simply closing up some of the contracts of last summer and will not be very busy until spring. From the amount of work that is being figured on now, it looks as if business, especially in the building line, will pick up again in the spring."

Business men generally, in Columbus, believe the present depression is only temporary, and that business will revive and flourish in the spring.

MANY LAID OFF

In Milwaukee Plants—Improvement Expected With Coming of New Year.

(Special Correspondence.)

Milwaukee, Wis., Nov. 30.—In Milwaukee fully 3,000 men are out of employment by reason of the financial and business depression. The Chicago, Milwaukee & St. Paul railroad alone laid off about 1,400 men at its shops. The entire locomotive department has been shut down, and over 400 machinists thrown out of work. The company also laid off many freight solicitors.

The Wisconsin Malleable Co. and Northwestern Malleable Iron Co. have reduced their hours of work an hour to an hour and a half a day. The employes are now working 8½ to 9 hours per day. In some instances this does not affect them greatly because they are piece-workers.

The Pawling & Harnischfeger Co. has laid off over 130 men. The Filer & Stowell Co. has also laid off about 100. The Allis-Chalmers Co. has laid off many men, but declines to state the exact or the approximate number, and declares that the men laid off were employed principally in the office, and that as a matter of fact it is constantly looking for good mechanics.

The Milwaukee plant of the National Enameling & Stamping Co. has been shut down, throwing 1,000 people out of employment. It will not reopen, according to present plans, until after Jan. 1.

Other and smaller plants have also laid off men, and complain that orders are being canceled, and that collections are slow. Other large institutions have retained practically their entire forces, and the absence of any manifestations of serious uneasiness among the mass of the people in this city is reflected in an optimistic mood among the manufacturers generally. No plants have been closed down entirely, and no departments that have been closed have as yet resumed operations. The feeling here seems to be that the situation will brighten after Jan. 1.

HANGING ROCK REGION.

Rigid Economy Will Be Practiced by Manufacturers—Reducing Wages.

(Special Correspondence.)

Ironton, O., Nov. 30.—While there is a general air of hopefulness among iron manufacturers relative to the prospects for the future, there is a general disposition to curtail expenses in all quarters and the furnaces that do not blow out in this district will be operated at the lowest possible expense until the market brightens. There has been practically no buying during the past week, despite the fact that $18 f. o. b. Ironton has been the price asked, and foundrymen are expecting still further concessions. It is stated that bids of $2 a ton furnace coke at the ovens have been rejected by West Virginia producers, who are holding out for $2.20.

Last week it was practically decided among the furnace men of this county, and their decision will make a precedent for the district, to make a reduction of from 10 to 15 per cent in the wages of furnace workers. Based on the wages of the filler, now $2.25 a day, the blast furnace workers of this district have received in the past 18 months increases aggregating about 25 per cent. The employes generally appreciate the situation of the market and will no doubt prefer a reduction which still leaves them above the wages of two years ago, to a suspension and no work at a season when it is needed.

Sarah furnace in this city was the first stack to bank its fires, announcing a suspension Nov. 24 on account of lack of orders. The firm utilized the greater part of its output in supplying the Ashland steel mills, which suspended earlier in the month. The Belfont furnace, also working on Bessemer, will likely blow out within the next week or two, as its product also went largely to the Ashland steel mills. The double stack of the Marting Iron & Steel Co. is still in blast, as is also the Hamilton furnace at Hanging Rock, and the Bird Iron Co. stack at Culbertson. These plants are working on malleable and foundry irons and will operate and work up their stock as long as it is feasible. As one manager puts it, "Iron is a better asset in pigs than it is in ore." The Jackson county furnaces are working on high silicon and expect to be able to find a demand that will keep them going rather steadily.

Owing to the blast furnace suspensions, all the fire brick plants at Sciotoville, O., have suspended operations.

Reports from Ashland are to the effect that the steel plant and rod mill there will shortly resume operation and there is some chance of the Portsmouth Steel Co. plant resuming before the first of the year. The Kelly Nail & Iron Co. plant here has announced a resumption within the week and the general outlook, while not so bright as it might be, is not discouraging to manufacturers, nearly all of whom are hopeful for the future of the trade. No suspensions other than those heretofore reported have been announced in this region.

RIGID CURTAILMENT

Is the Rule in Eastern Pennsylvania—Cement Industry Affected.

(Special Correspondence.)

Philadelphia, Nov. 30.—In eastern Pennsylvania the depression has fallen most severely upon the pig iron and cement industries, in which it is very keenly felt. Of the blast furnaces in this district fully 60 per cent have been put out of blast in the last few weeks, and a still greater curtailment is contemplated if there is no improvement in the near future. The Empire Steel & Iron Co. has blown out four of its eight furnaces, the Thomas Iron Co. five out of nine, the Lackawanna Steel Co. all of its five, and smaller concerns operating two or three furnaces have generally one at least out. Among rolling mills and other makers of finished or semi-finished products no absolute suspensions of any important concerns are reported, but many are running on reduced time or with diminished forces. The Baldwin Locomotive Works, of Philadelphia, which in rush days employed as many as 21,000 persons, has reduced its force to 18,000, and has orders enough to keep it busy for several weeks. Other large industries in that city, such as the Pencoyd Iron Works and the Midvale Steel Co., report much the same state of affairs. In the Lehigh valley the depression has fallen with especial severity on the cement plants, which are almost entirely dependent on new work, such as the construction of concrete buildings, the erection of bridges, etc. Nearly all of these are preparing to close, either entirely or in part, and thousands of

employes have been laid off, mostly to return to Europe. The action of these concerns indicates the belief that for some little time new work requiring cement is to be reduced to a minimum.

CANADIANS CHEERFUL

In Spite of Temporary Suspensions and Reductions of Working Forces.

(Special Correspondence.)

Toronto, Canada, Nov. 30.—The effect of the existing financial stringency upon the iron trade and general manufacturing industries of Toronto has been manifested in a slackening of activity and the reduction of staffs. A large number of men have been laid off, but it is difficult to determine how far this reduction is directly traceable to financial conditions, as it is usual with many establishments to make some decreases at this season. A rough estimate gives the number of men displaced in the metal trades during the last few weeks at about 1,000, but many of them have obtained employment in other establishments. Manufacturers, as a rule, are simply filling orders and not manufacturing for prospective trade. This conservative policy, which has been necessitated by the attitude of the banks in refusing to make advances, has not resulted in the closing down of plants, though it has operated in checking expansion and decreasing forces.

The American Abell Engine & Thresher Co., employing 500 men, closed down Oct. 15, in accordance with its usual practice of suspending operations for about a month every fall for stock-taking and repairs. Owing to the existing financial conditions, the plant will remain shut down longer than usual, reopening about the first of the new year with a reduced staff.

The Toronto and Bridgeburg, Ont., yards of the Canadian Ship Building Co. were closed down a few weeks ago. At the Toronto yard, where some 300 men were employed during the summer, reductions had been steadily made for some months as contracts were completed. The yard will remain closed during the winter. The Bridgeburg yard, on the Niagara river, where operations were suspended for reconstruction after a fire, will be reopened next week.

Some weeks since the Canada Foundry Co. laid off about 150 men out of a total force of some 2,000. There has been no further reduction.

The Massey-Harris Co., manufacturer of agricultural implements, etc., states that it has employment for its normal staff with a good demand for its output in this line, though in other branches of its industries it may be necessary to make some reduction.

There is a general feeling of confidence among manufacturers, the prevalent view being that the present crisis is purely financial, the whole trouble being a want of adequate funds, and not arising from an overstocking of the market or a falling off in the demand for manufactured goods. The pressure is considered as merely temporary and a resumption of activity is anticipated with easier money.

A feature which is largely local has considerably accentuated the unfavorable aspect of the situation and given rise to exaggerated reports of depression. There has been for some time a large number of unemployed laborers, both skilled and unskilled, far in excess of normal requirements owing to extensive immigration encouraged by the Canadian government. Many of these who found temporary employment on farms or in connection with railway construction, navigation or other outdoor work, have come to the city at the close of the open season. The presence of several thousand unemployed, many of them in circumstances of great destitution, from causes quite apart from the financial difficulty, has naturally made industrial conditions appear worse than they really are.

FEW FURNACES

Are Now in Operation in Alabama—Italian Laborers Arrive.

(Special Correspondence.)

Birmingham, Ala., Nov. 28.—The Tennessee Coal, Iron & Railroad Co. has but one furnace (Bessemer) on foundry iron with five (Ensley) on basic iron. The Sloss-Sheffield Steel & Iron Co. has two furnaces on foundry iron. The Republic Iron & Steel Co. has one on foundry, the Southern Steel Co. one on basic, the Alabama Consolidated Coal & Iron Co. two on foundry, Shelby Iron Co. one on charcoal, Woodward Iron Co. two on foundry, Woodstock Co. one on foundry, Birmingham Coal & Iron Co. one on foundry and one furnace at Holt, in Tuskaloosa county, is also in blast.

There have been no furnaces blown in during this week and no intimation that there will be any started up in the next few days. Many rumors prevail, but nothing definite is in evidence. Construction work at the new steel plant of the Tennessee Coal, Iron & Railroad Co. at Ensley is resuming, quite a number of laborers being put to work during the past week. Several hundred Italians have arrived in the Birmingham district in the last few days, taking the places of those who left here not many days ago.

IMPORTANT IMPROVEMENTS

Will Be Made by St. Louis Terminal Railroad Association—Many Men Idle.

(Special Correspondence.)

St. Louis, Nov. 28.—With approximately 30,000 men out of employment in St. Louis and 10,000 in East St. Louis and the announcement today that the various industries of the North American Co. in St. Louis will lay off an additional 1,500 men, comes the further announcement that the St. Louis Terminal Railroad Association will expend $4,000,000 in the construction of viaducts, tracks and bridges.

Officers of the terminal association in conference with members of the St. Louis municipal assembly gave assurance yesterday that plans for its proposed improvements would be presented to the city authorities for approval next week, and that the work would be rushed to completion with all possible speed. The improvements contemplate a series of team tracks to accommodate 1,550 cars, Pullman and coach tracks, a viaduct, a new freight depot, and possibly a subway through a portion of what is known as Mill Creek valley.

The terminal association had virtually decided to postpone improvement work for several months, owing to financial conditions, but the municipal bridge and terminals commission having charge of the work of building the new $3,500,000 free municipal bridge between St. Louis and East St. Louis, insisted that construction work begin at once, and this determination caused the unexpected activity manifested by the terminal association.

The announcement has had the effect of relieving to some extent the anxiety caused by the temporary closing down of manufacturing plants, because of money stringency, overproduction of goods, or other similar excuses.

In East St. Louis, the American Aluminum Works, with branches in Pittsburg, Niagara, New York city and Canada, closed down Nov. 23, throwing 1,600 men out of employment. Overproduction is assigned as the cause.

The American Steel Foundries

plant at Granite City, Ill., near East St. Louis, closed down permanently two weeks ago. About 2,400 men are affected.

The Republic Iron & Steel Co.'s works, East St. Louis, closed last Saturday, laying off 1,200 men, but resumed operations the following Monday with a force of 400 men. The company promises to put on 400 more men next Monday.

The Elliot Frog & Switch Works, East St. Louis, says it has contracts ahead for enough work to keep it in operation night and day for five years.

The Missouri Malleable Iron Works, East St. Louis, is running with a full force of 3,000 men.

The Niedringhaus Stamping Works at Granite City closed down last night, with orders to resume operations on Dec. 9. G. W. Niedringhaus, president of the Granite City National Bank, said that the Granite City Steel Mills would start up Dec. 16, and that after Jan. 1 all of the plants controlled by the National Enameling & Stamping Co. in Granite City would resume work with full forces.

The bi-monthly payroll of the Granite City Steel Mills amounts to $53,700 and at the Commonwealth Steel Foundries, $37,785.

The shutting down of big plants in St. Louis has in nearly every instance been followed with a resumption of operations within a few days, the temporary closing being attributed to difficulty in getting cash for payrolls in some instances, but more frequently to overproduction.

Very few of the large St. Louis manufacturing plants employing traveling salesmen have called their men in.

The banks in St. Louis and in East St. Louis are releasing currency to a limited amount for payrolls, and assure the business men that the financial cloud is gradually disappearing.

READY TO RESUME

Are Indiana Manufacturers When Cash Payments Are Restored.

(Special Correspondence.)

Indianapolis, Ind., Nov. 30.—Indiana manufacturers who have been compelled to close down or cut their forces, are only waiting for the restoration of cash payments by banks to resume operations as usual.

There is, however, but little improvement in the situation as it was three weeks ago. A few concerns that closed have reopened and some of those that cut their forces have taken a few more employes back. Other factories, however, have been affected, so that there has really been little improvement. Nordyke & Marmon, E. C. Atkins & Co., and the Atlas Engine Works are all working with short forces. It is said that only two factories in Muncie are working as usual, while at South Bend the implement and vehicle manufacturers are all working on eight hours time.

Local manufacturers all have large orders on hand, but many of them are afraid to ship until the financial situation grows clearer; others are unable to manufacture their products because they cannot get enough currency to carry on business. Indianapolis banks are ready to resume cash payments when Chicago and New York gives the word. There are about 7,500 men out of work in this city at present.

IMPROVEMENT REPORTED

From Various Cities to Branch of National Metal Trades.

An improvement in sentiment and actual conditions over several weeks ago, throughout the country, is the result shown by a recent general inquiry into the situation, made in behalf of the membership of his organization by Secretary P. H. Frankel of the Cleveland branch of the National Metal Trades Association. The reports made from the various business centers are as follows:

Boston.—Conditions commencing to show up better.

Buffalo.—Some weeks ago firms began laying off men and running a shorter day and shorter week. Things are commencing to look bright and it is the belief that matters will shape themselves nicely after the first of the year, when there will be more business than ever.

Chicago.—The general feeling prevails that the conditions of affairs have improved considerably during the last week or ten days. There is more confidence and a better outlook for the future. Further inquiries and new orders are expected after the first of the year and then in a conservative manner.

Dayton.—The conditions are the same in all cities having a diversified manufacturing industry. Things are commencing to look better here.

Detroit.—Some few weeks ago plants began running short. However, now good men are finding employment, not altogether at full time as yet. No one seems to be suffering; many of our largest institutions have increased their capital stock and are running full and we expect things to be normal very shortly.

Indianapolis.—In talking with many local manufacturers, all appear to be sanguine regarding the present situation. Any number of them are proceeding with contracts as usual. There is no cause for alarm. The money market here shows material improvement. Business here again shows signs of returning to normal conditions. Altogether Indianapolis is in fine shape.

Louisville, Ky.—This section of the United States seems at present to be in splendid condition. With regard to the money market we are glad to say that the banks have more than held their own. While some of the manufacturing establishments have been running shorter handed, the majority of our best informed people seem to think that the general stringency which has prevailed will not last very much longer.

Milwaukee.—People here are as a rule optimistic as to the future. While new orders have been coming in slow within the last week, there has been an improvement in the situation. From the general feeling expressed by our business people money is getting easier. We look for a decided improvement by January.

Philadelphia.—A number of the manufacturers are running their plants four days a week or, in other words, on an average of 40 hours a week in place of 55 as heretofore. Some of the shops are running three days a week and some on full time with the force considerably reduced. As in other cities the shops have been paying off in checks. From the present outlook there will be thousands of unemployed mechanics in Philadelphia by the first of January, as the Baldwin Locomotive Works, who have had 22,000 men in their employ for the last two years, have arranged to discontinue their night gang, which will reduce their force one-half, and it is possible that they will reduce the day gang one-third. All hope for a bright outlook in the future.

Pittsburg.—Business has been slowing up, but manufacturers figure that the sooner the bottom is reached just so much sooner will the reaction set in. In conversing the financial situation with several business men they stated that they saw signs of improvement in the local situation very soon. There is a better feeling all around and early in the New Year there will be an accumulation of loanable funds that will continue for some time.

Syracuse, N. Y.—Syracuse seems to be an exception. A number of manufacturers are working nights and have more than they can do. There have been very few men laid off, but not to amount to anything. Everything looks bright along this line, more so than it has for some time. We have the utmost confidence in being able to continue the prosperity we have had for several years.

Toronto.—Here in Toronto we have had the same difficulty as you in the United States, the tightness of the money market. There is considerable business on hand, but we have not had the necessary cash to swing it. As far as our experts are able to gage there are none of the evidences at hand of a lengthy depression. Any uneasy feelings prevailing at this time, however, will soon pass away as the result of the healthful condition of the country.

ANOTHER MANUFACTURER OF BIG GAS ENGINES.

As an indication of the rapid development in the manufacture of large gas engines and the importance of the field occupied by this type of prime mover, it is of interest to note that another manufacturer of large Corliss steam engines has actively taken up the manufacture of gas engines, and is bidding strongly for engines in medium and large sizes.

The Wisconsin Engine Co., with works at Corliss, Wis., which has built some very large and successful Corliss steam engines, is building gas engines for all services in sizes from 400 brake horsepower to 5,000 brake horsepower. The engines utilize natural gas, producer gas, coke-oven gas or blast furnace gas in the Otto cycle (4-cycle), and are of the horizontal tandem and twin-tandem double-acting type. This company controls the Sargent patents on internal combustion engines and has employed Charles E. Sargent as engineer of its gas engine department. Mr. Sargent has a wide reputation as an engineer, and in 1898 designed, it is claimed, the first successful horizontal tandem double-acting gas engine, which was a wide departure from the accepted practice of those days, when a prominent manufacturer of gas engines declared such a type was impracticable, and doomed to failure. However, the largest and most successful gas engines are of the horizontal twin-tandem double-acting 4-cycle type, and with one exception this is the only type in which large units are being built in this country today.

The gas engines built by the Wisconsin Engine Co. bear some of the distinctive features of its Corliss engines, and utilize in design most of the Sargent patents. The design is simple and embodies features which are of considerable interest to the engineer and power user. There is but one poppet valve for each explosion chamber, and as this is located on the bottom of the cylinder the air and gas pipes, as well as the stairs, galleries, and railings found on many horizontal tandem engines, are entirely eliminated; provision is made for preventing the dangerous pressures caused by possible pre-ignitions; and the engines are started automatically.

Tests of even small Sargent engines show a heat consumption of less than 9,000 B. T. U. per brake horsepower-hour.

This company has recently shipped some large steam engines to the Illinois Steel Co., Jones & Laughlin Steel Co., Packard Motor Car Co., American Sheet & Tin Plate Co., Amoskeag Mfg. Co., New Hampshire Spinning Mills, National Tube Co., City of Milwaukee, Carnegie Steel Co., American Woolen Co., United States Envelope Co., and the Carnegie Natural Gas Co.

PHILADELPHIA GEAR WORKS' NEW BUILDING.

Preparation for its later extension to meet the needs of a growing business is a feature of the new building of the Philadelphia Gear Works, Inc., 1120-1122 Vine street, Philadelphia. This structure is located in a densely populated section of the city, where the question of ground space is of such importance that the securing of additional manufacturing room can only be accomplished by an increase in the number of stories. The present building, fronting 37 feet on Vine street and running back 100 feet along the Reading tracks through to Winter street, now includes three stories and basement, but the solid timbering of the framework and the thickness of the brick walls are such that two stories may be added whenever needed. Furthermore, the flooring of the fourth story is already in place, just beneath the present roof, and holes are already cut for the upright columns, with the idea that the projected additions can be made without disturbing activities on the lower floors, as the present roof can be left in place until the extensions are complete.

The new building is extremely well lighted. With frontage on two streets and a railway line, an abundance of natural light is insured and the most of this advantage is made by the maximum number of large windows on all floors. The interior walls are finished in white and headroom of 14 feet throughout the building, even in the basement, still further adds to this advantage. The artificial lighting of the plant is electrical.

Unusual difficulties were overcome in laying the basement floor, as it extends 17 inches below the sewer level and a bed of quicksand was encountered in sinking the foundations. This necessitated the installation of arches. Above this was built the floor, consisting of 2½ inches of cinder concrete, ½ inch of asphalt, above this 3 inches more of cinder concrete, and the whole topped with 2-inch planking. In the concrete and asphalt were imbedded 5-inch sleepers, and the whole was French strained into a water siphon pit. The result is a floor that is thoroughly dry and solid, giving ample support to the coal bins, a 25-horsepower gas engine, a gas forge built by the Western Gas Furnace Co., all the turning equipment of the plant and other machinery.

A heavy freight elevator is located in the middle of the building and at the inside front corner is the fire tower, carrying all stairways. The front of the street floor is devoted to office purposes, with a large department and gallery equipped with racks for storage of gears. The office is finished throughout in white. Immediately to the rear is a large section devoted to manufacturing, with an office for the superintendent. Throughout the building the shaft drive is employed, the main floor being provided with a heavy center drive and two side shaft drives. All shafts run in Standard roller bearings. In the case of connections with the various machines an interesting test is being made, Schultz, Ruboil and Leviathan beltings being employed under similar conditions with the idea of determining their comparative merits.

On the second floor the front is given over to tool room purposes, with the pattern shop immediately in the rear. The upper floorings are of ⅞-inch maple laid over 3-inch tongued and grooved floor. Power is provided by two 25-horsepower gas engines, one an Otto and the other a Miami. To provide for emergencies, one is located in the basement and the other on the second story, driving arrangements being such that the entire equipment of the plant can be connected with either engine. The machine tool equipment is very complete, but a number of additional machines are now in the making.

Other features of the plant include a complete Keystone interchangeable telephone service, connecting all departments and allowing communication within the plant without interfering with outside service. Individual water basins are being installed and the other sanitary arrangements are good.

The Philadelphia Gear Works has just entered this plant, removing from 123-127 North Seventh street. George B. Grant is president and mechanical engineer and George L. Markland Jr. treasurer and business manager. The concern has tripled its business in the last six years. Its new plant was opened Nov. 22 with a housewarming reception and dance tendered its employes and friends.

THE MANUFACTURE OF CAST IRON PIPE

Description of the Continuous Process of Making Pipe in the Largest Pipe Foundry in the World

BY W. B. ROBINSON

A NEW PLANT for the continuous manufacture of cast iron pipe, equipped for an estimated output of 750 tons daily, has just been completed at Scottdale, Pa., by the United States Cast Iron Pipe & Foundry Co. In designing the plant the pit method generally used has been adhered to, but tables have been installed on which the flasks revolve for the successive molding, drying, casting and shaking out operations. The molds are rammed by machine, which is a distinct departure from the practice now prevailing not only in this country, but Europe as well.

The four casting pits have been installed in two units, each served by three jib cranes. The crane which serves the rammers of each pit, removes the flasks after the molds have been poured and places them horizontally on skids over a sand pit where the clamps are removed and the pipe shaken out of the flasks. The sand is tempered in the pit and is removed by the same crane and placed within reach of the molding machines. The electric ramming machines, one of which is shown in Fig. 7, are anchored in the center of the pit, having arms extending the radii of the tables to bring the ramming devices directly over the flasks. Each table is served by a jib crane which sets the cores and pours the iron.

The 32 core ovens are built in units of eight, each serving one pit, two being located at either end of the foundry and the other two in the center, backing each other. The coremaking machines are distributed along one side of the plant opposite the cupolas, each machine serving one oven. The four cupolas, which melt continuously, have been installed in a furnace house erected at the center of one side of the plant, the ladles being delivered to the jib cranes by an overhead tramrail system. The four finishing sheds are built at right angles to the main building, each serving one table. The movement of the pipe after being cast is toward the cars in which they are to be loaded, or the yard where they are to be stocked, in the meantime passing the cleaners, chippers, pipe heating ovens, dipping tanks, scales and testing machines.

The Foundry.

The main building extends north and south and is approximately 125 feet wide and 700 feet long. The cupola house is located at the middle of the west side of the main building and is 40 x 70 feet. The blower room is located on a mezzanine floor underneath the charging platform. The four finishing sheds for cleaning, coating and testing the pipe extend in an easterly direction from the main building. Each shed serves one of the four revolving tables, those at either end being 350 feet long and are provided with heating ovens, scales, dipping tanks and testing machines, while the sheds extending from the two middle tables are connected to those at either end by means of transfer runways over which the pipe is conveyed to the dipping tanks and test houses.

The boiler and compressor house, Fig. 17, has been erected between the two shorter sheds where the steel tank and tower for the water supply are located. All of these buildings have tile roofs with side walls of concrete, the lower portion being 9 inches thick, while the upper section between the windows is reinforced and is 2 inches in thickness. The floors of the blower room and the charging platform are also made of reinforced concrete, as are the

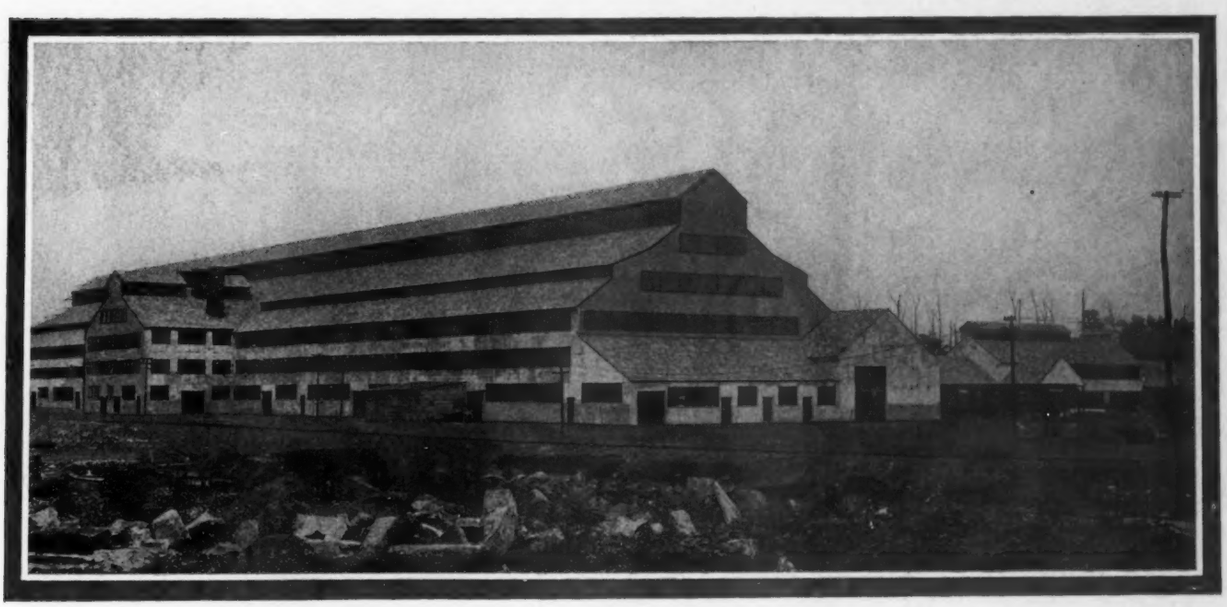


FIG. 1—NEW PLANT OF THE UNITED STATES CAST IRON PIPE & FOUNDRY CO., SCOTTDALE, PA. VIEW SHOWING THE FURNACE HOUSE

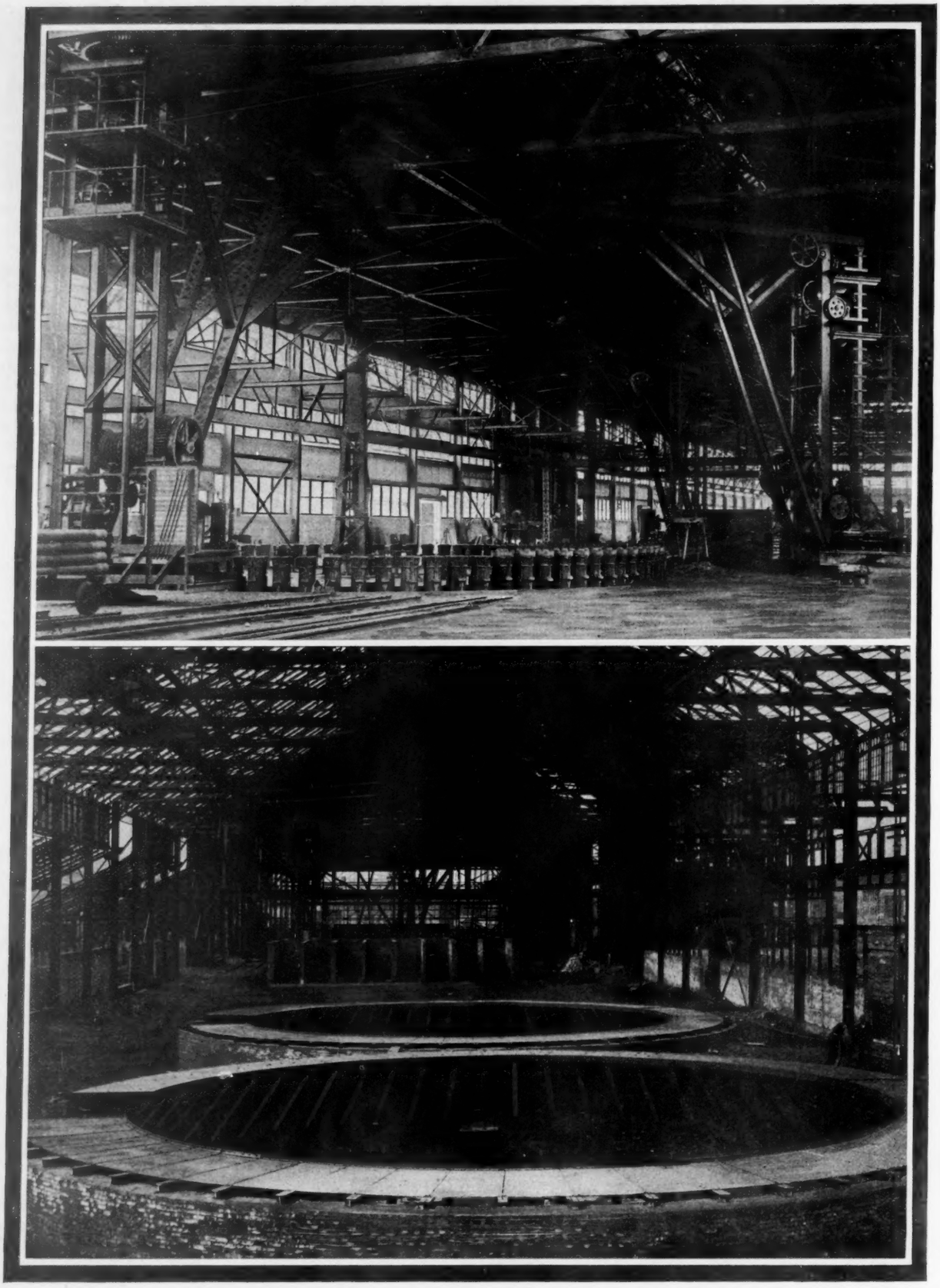


FIG. 2—VIEW OF ONE OF THE REVOLVING TABLES, SHOWING JIB CRANES
FIG. 3—CASTING PITS UNDER CONSTRUCTION, WITH ONE UNIT OF EIGHT CORE OVENS IN THE BACKGROUND

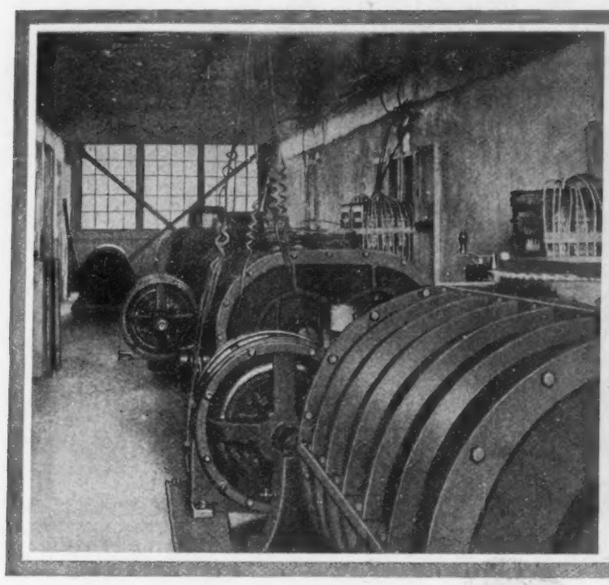


FIG. 4—BLOWER ROOM ON MEZZANINE FLOOR

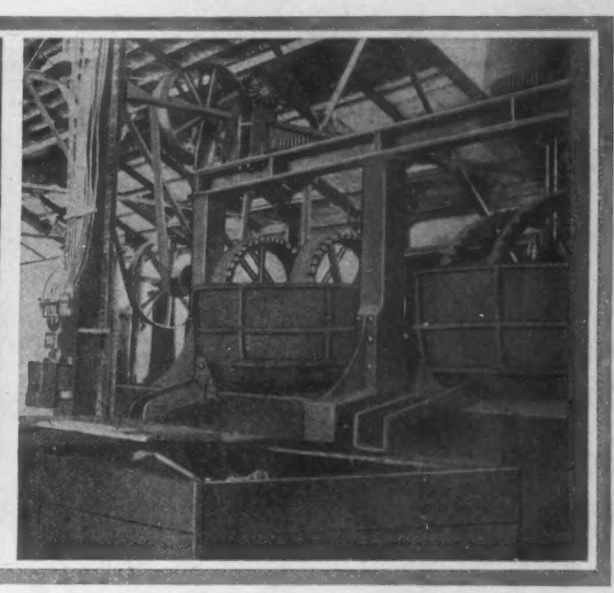


FIG. 5—A PAIR OF MUD MILLS

walls of the blower room, which are made heavier to resist the suction of the blowers.

Light and Ventilation.

To prevent the accumulation of cinders on the roof its pitch is somewhat greater than ordinarily specified. Proper ventilation is secured through louvres on the side of the main dormer and the additional continuous louvres at the break in the roof. The windows over the core ovens are pivoted with shaft sprocket wheels leading to the floor and provide additional ventilation. Ample lighting facilities are provided by large and continuous windows in the sides and ends of the building, as may be seen in Figs. 1 and 19. The doors throughout the plant are of steel, rolling shutter type. The frame work is steel throughout and all of the buildings are fireproof. To withstand the action of fumes and gases which are prevalent in a plant of this kind the sheet metal work is of copper and the tiled roof gives additional protection.

Owing to the large number of trolleys and overhead runways installed in the plant the bottom chords of the roof trusses have been braced with heavy angles. The jib cranes serving each of the revolving pits have been especially designed by the engineering department of this concern and are built for heavy service. The plant was erected under the direction of F. A. Field, consulting engineer of the company, and J. E. Tinstman, superintendent of the foundry.

Revolving Tables.

The four revolving tables are distinct departures from ordinary pipe foundry practice. The United States Cast Iron Pipe & Foundry Co. installed the first revolving table in this country at its Chattanooga plant. The diameter of the Scottdale pits has, however, been increased to 74 feet as compared with 27 feet 10 inches at Chattanooga. The revolving pit

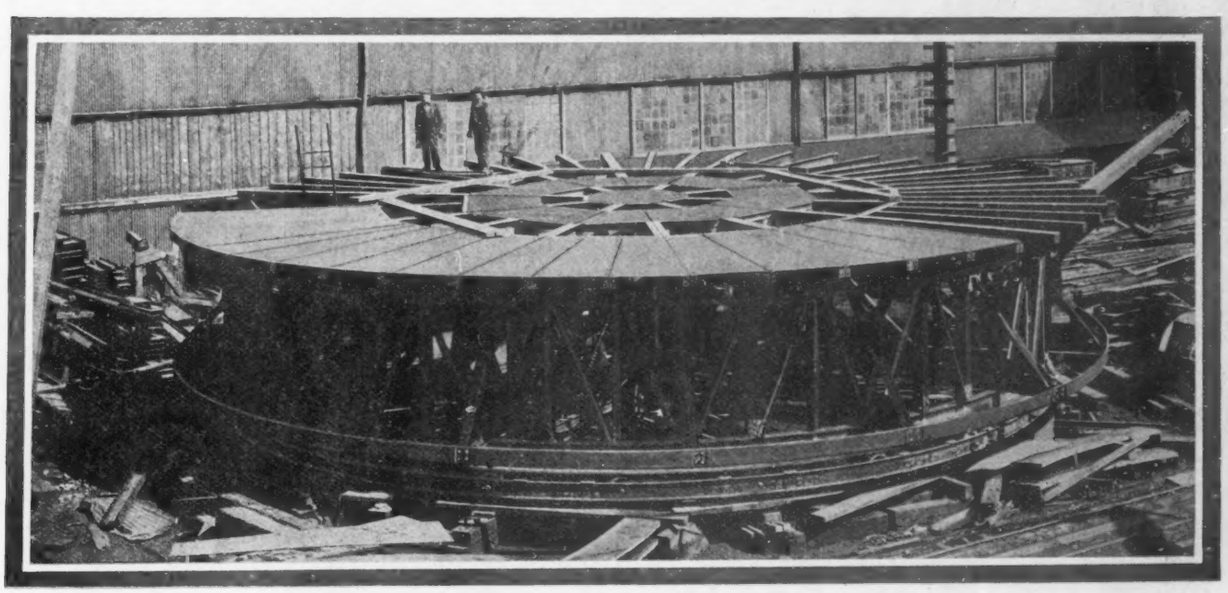


FIG. 6—REVOLVING TABLE UNDER CONSTRUCTION.

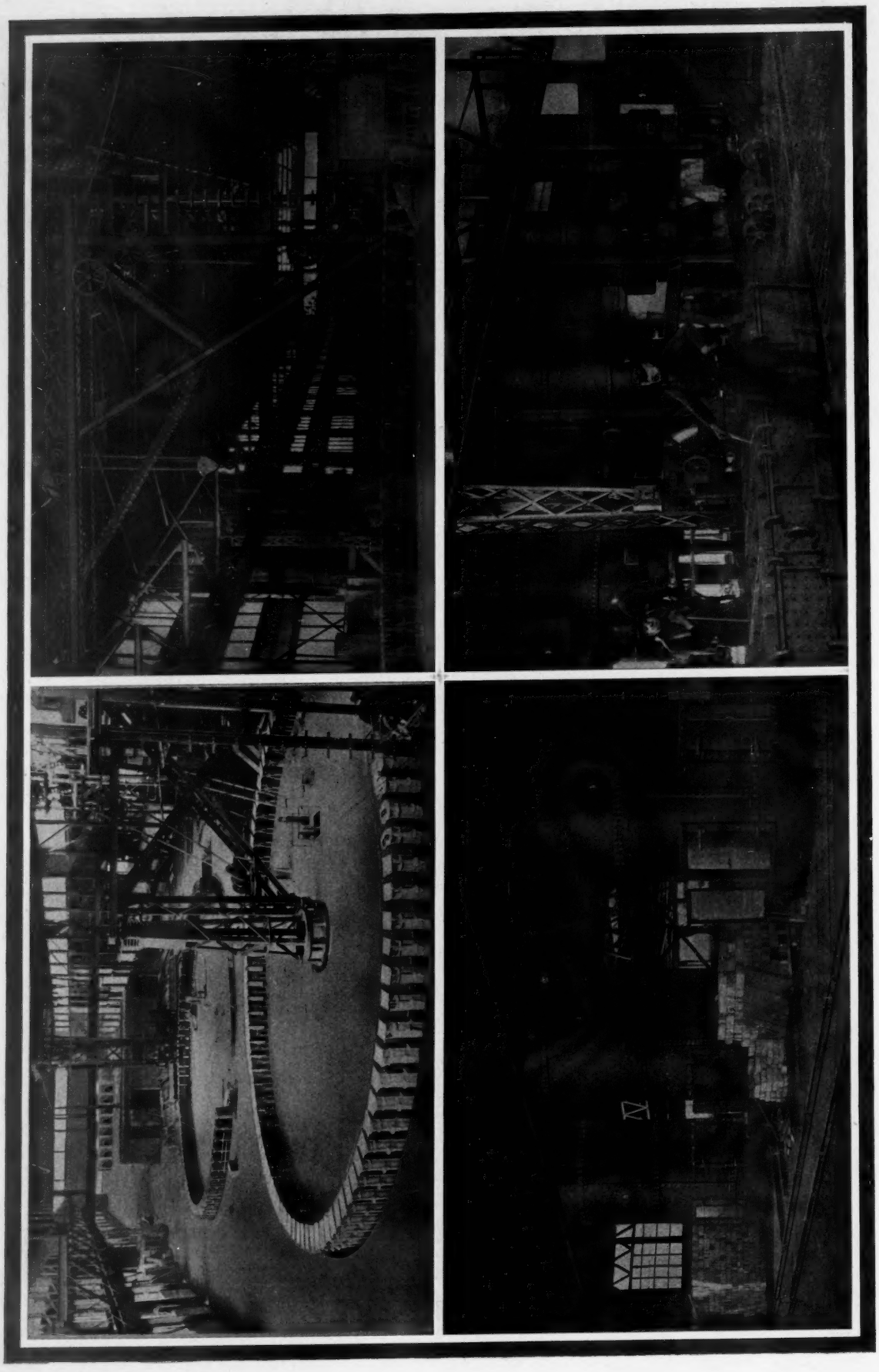


FIG. 9—JIB CRANES USED FOR SETTING THE CORES AND POURING THE IRON
FIG. 10—THE FOUR CUPOLAS

FIG. 7—CASTING PITS SHOWING ELECTRIC RAMMER
FIG. 8—CUPOLA CHARGING FLOOR

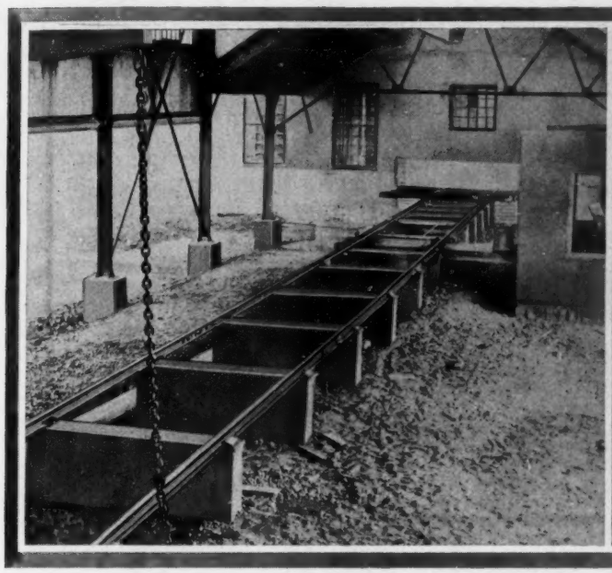


FIG. 11—SKID FROM THE HEATING OVEN TO DIPPING TANK

FIG. 12—CLEANING SHED SHOWING SKID FOR CASTING PIT

tables for carrying the flasks are supported on heavy concrete foundations surmounted by circular steel tracks. The tables are built up of structural steel shapes and are covered with steel plates. They are pivoted in the center and also travel on an outside track. Twenty per cent of the load is carried on the center and 80 per cent on the track. Each table has a capacity of 94 double flasks for pipe up to 6 inches in diameter, or 58 double flasks for 12-inch pipe. The total weight of the table, including the flasks with the castings, is 700 tons. Each table has a diameter of 47 feet, the pit proper being 74 feet in diameter. Each table is revolved by a 10-horsepower alternating-current motor, and is provided with an electrically operated ramming machine. The rammer has a rotary motion around the pattern and by its use the sand is packed more uniformly than by hand. With the revolving tables three casts will be made daily. This can be readily accomplished, inasmuch as the molds after being rammed pass over coke fires in the pits and are dried before the cores have been set. The coke stoves extend two-thirds of the circumference of the pit and the gases pass up through the molds, which practically serve as chimneys. Immediately after the molds have been dried and the cores have been set the table is revolved and the molds are poured. In the meantime, other flasks which have been shaken out and which have again been returned to the table by one of the jib cranes are being rammed and passed over the coke fire, the cores set, and the operation repeated. Prevailing practice provides for the drying of the molds at night and their casting the next day. By this continuous operation the mold is finished and the casting made within a little over three hours.

Crane Service.

Each of the revolving tables is commanded by two electric jib cranes,

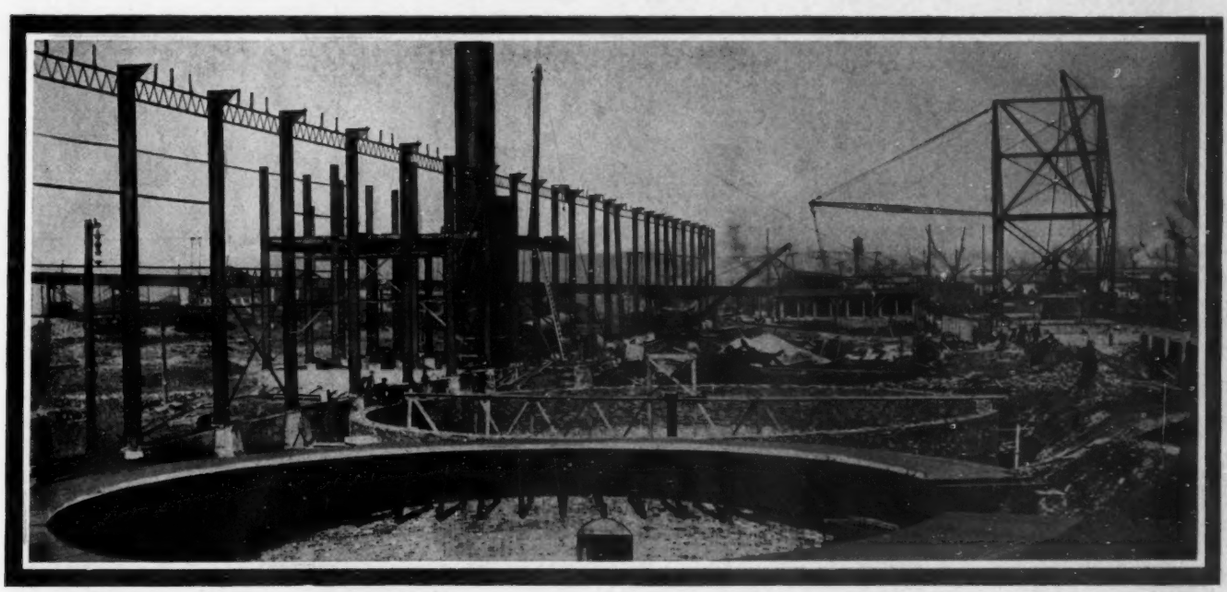


FIG. 13—CASTING PITS UNDER CONSTRUCTION

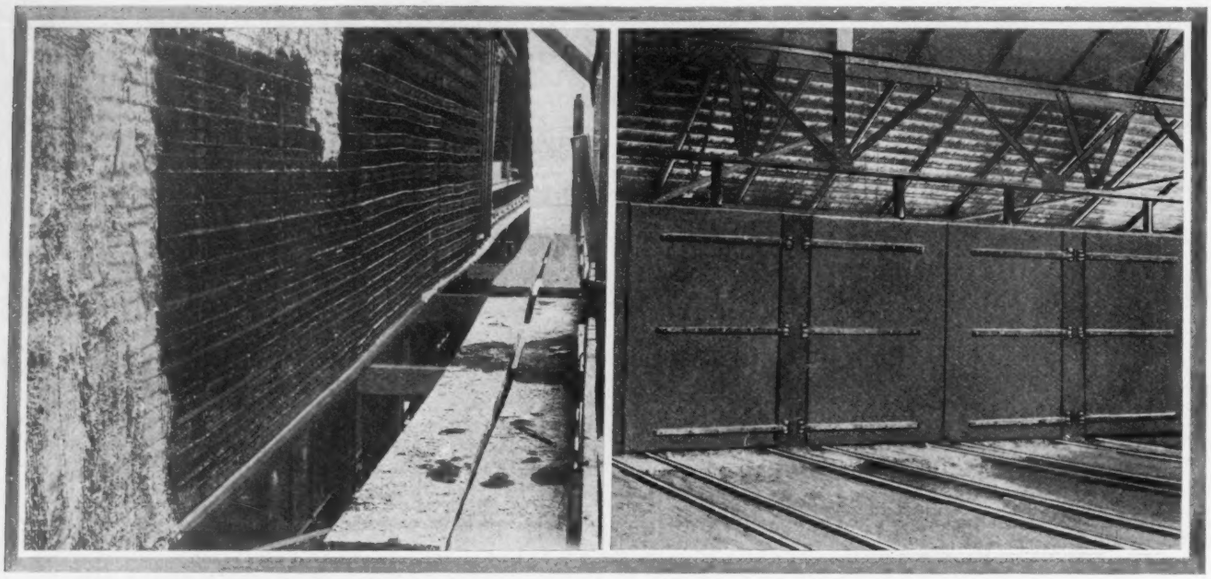


FIG. 14—EXPANDED METAL AND CONCRETE FOUNDRY CURTAIN WALL CONSTRUCTION

FIG. 15—SECTION OF ONE OF THE CORE OVEN UNITS

the one located between the tables of each unit serving both, making three cranes for each unit. There are four cranes of 10 tons capacity each which pour the iron and set the cores and two that shake out the pipe, return the flasks to the tables and serve the electric rammers as the tables revolve. The cranes serving the pits revolve at a speed of 560 feet per minute and have an effective radius of 38 feet. They are provided with three motors each, one of 50 horsepower capacity for hoisting, one of 15 horsepower for slewing, and one of 10 horsepower for racking, and are controlled by foot brakes. There are two speed attachments for the hoists of the cranes, one giving a speed of 150 feet and the other of 95 feet per minute. The low speed is used for handling hot metal and the high speed for the flasks and cores. The speed of the rack on the jib casting cranes is 85 feet per minute.

Cupolas.

The furnace room is 40 x 70 feet and is equipped with four 84-inch cupolas. Fig. 10, having melting capacities ranging from 14 to 18 tons per hour. Thus far they have averaged 16 tons per hour on a 10-hour run, melting with a ratio of over 11¼ tons of iron to one ton of coke, including the bed. While the shells of the cupolas are 84 inches in diameter, the diameter inside of the lining is 66 inches. They are of the regular Newten patent type installed by the Northern Engineering Works, Detroit, but the stacks have butt riveted joints and the air chambers are somewhat deeper than the standard types.

The blower room, Fig. 4, as previously stated, is located on a mezzanine floor underneath the charging platform, thus reducing the lengths of the blast pipes to the minimum. The blast pipes are so arranged that the cupolas can be operated individually or in pairs. The blast is generated

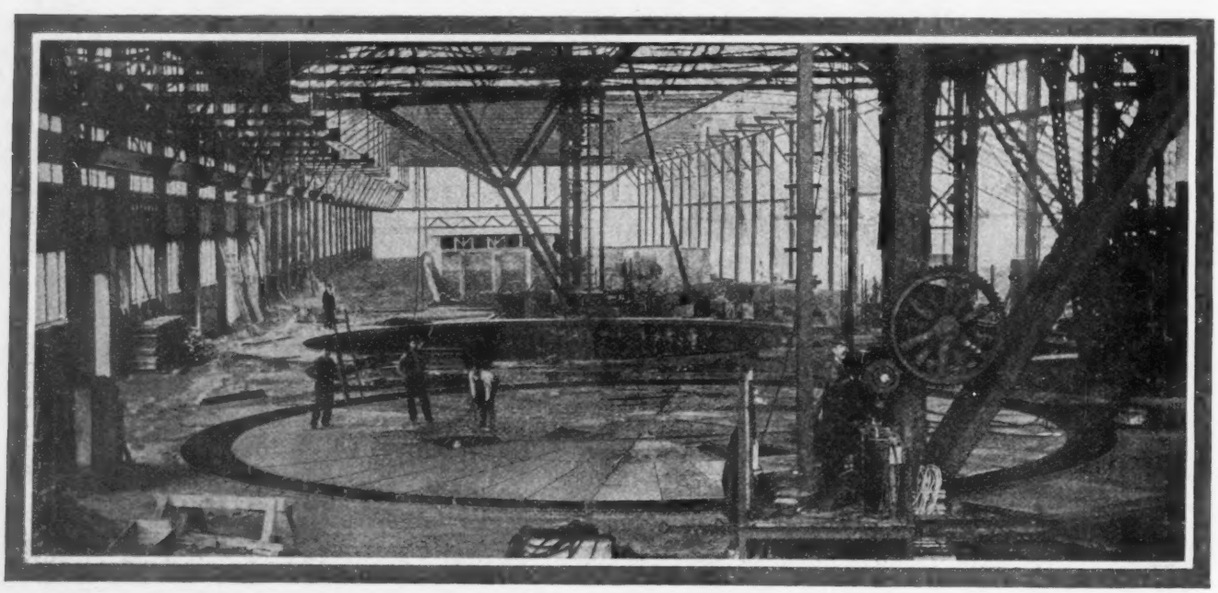


FIG. 16—INSTALLATION OF ONE OF THE TABLES

FIG. 17—COMPRESSOR HOUSE

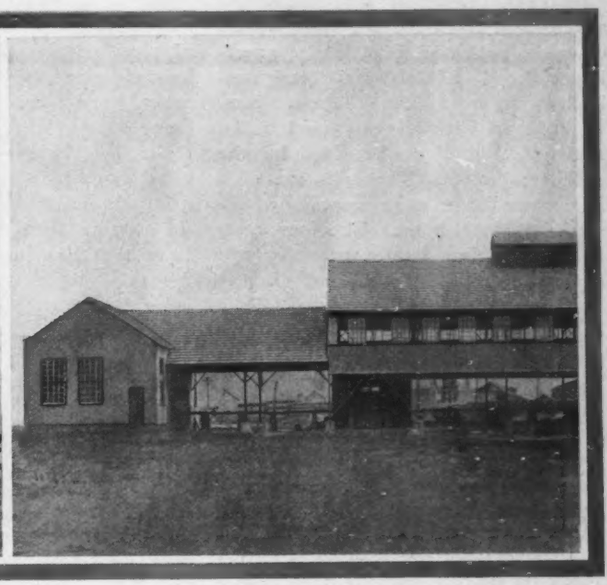


FIG. 18—DIPPING TANK AND TEST HOUSE

by four positive pressure blowers, two having been installed by the Wilbraham-Green Blower Co., Philadelphia, and the other two by the P. H. & F. M. Roots Co., Connersville, Ind. Each blower is direct-connected to a 50-horsepower motor.

While the cupolas are still being charged by hand, two hydraulic charging machines are being built, each to serve two cupolas. The cupolas will be charged by the operator and only two men will be required on the charging floor instead of 12 at the present time. When the new machines are installed the charging buggies loaded with material will be transferred over tracks on the charging floor to a point directly in front of the cupola charging doors. It will then be raised by the hydraulic plunger and the material will be charged directly into the cupola. The charges at present are made up in the yard and are elevated to the charging floor on a 2-cage electric elevator having a capacity of four tons.

Hot Metal Tramways.

Metal from the four cupolas is conveyed to the casting pits by two electrically operated overhead tramways, one serving casting pits 1 and 2, and the other pits 3 and 4. The controller for each trolley is placed on a pendant attached to the carriage of each traveler and moves with it from the cupola to the tables. The controller for conveying the metal is operated by the cupola tender, who starts the trolley with its ladle of iron to the casting pit, and the trolley is stopped by the workmen at the pit, thus eliminating one man who would otherwise be compelled to travel with the machine.

In a lean-to built at the east side of the main building and extending its entire length, with the exception of the breaks occasioned by the runways for the pipe sheds are the loam, sand and clay bins, which have a total length of 650 feet, are 23 feet wide and 13 feet high. The material used in the preparation of cores, and stored in these bins, is received over

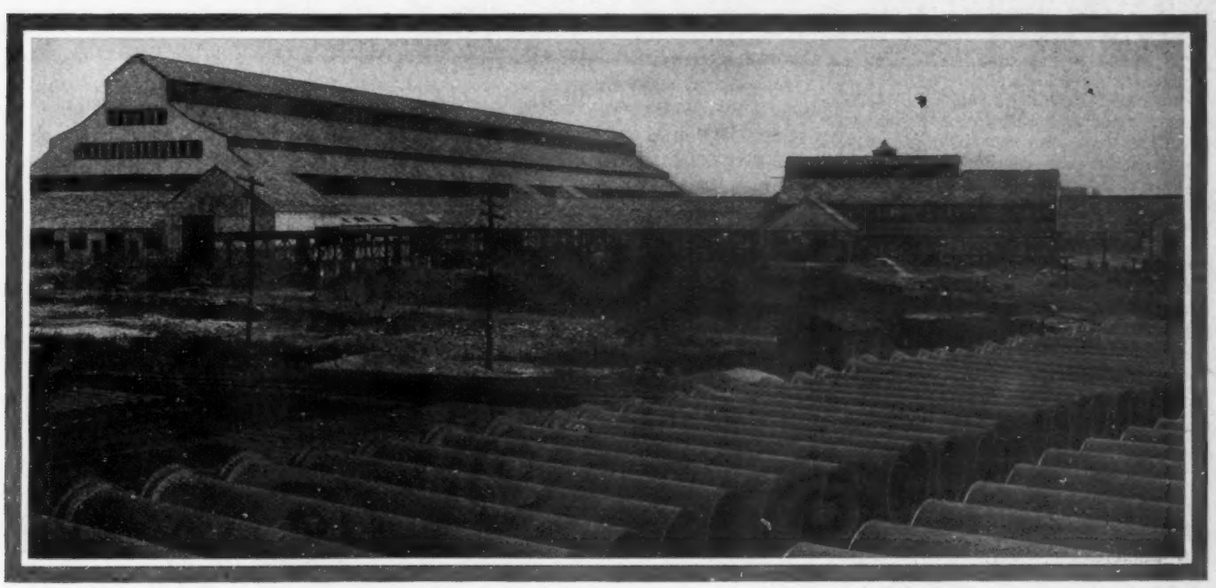


FIG. 19—ANOTHER VIEW OF THE FOUNDRY

an elevated track 740 feet long which connects with the Scottdale connecting railroad, all material being unloaded from hopper bottom cars. Eight loam grinders or mud mills, shown in Fig. 5, are provided for the core department. The mills are of a new type and were especially designed for this plant. The four core-making machines located near the core ovens, are motor driven and produce two cores at each operation. Each core machine is served by two of the mud mills, and each of the 4 and 6-inch core machines is commanded by one 2-ton electric traveling crane. The 8-inch and 12-inch core machines are each served by one 3-ton electric traveling crane. The thirty-two coke fired ovens are distributed throughout the plant in four units of 8 ovens each, a section of the ovens being shown in Fig. 15. Each unit has a capacity for drying 150 12-inch cores or 450 4-inch cores. They are heated by furnaces of a special design and can be equipped for gas if desired.

Cleaning, Dipping and Testing.

The four pipe cleaning sheds are built at right angles to the east side of the main building at points directly opposite the revolving tables. Those extending from tables 1 and 4 are equipped with heating, dipping and testing appliances. At the end of pipe cleaning sheds 1 and 4 are located pipe drying ovens, dipping tanks, and the hydraulic testing houses. At the second revolving table the 175-foot shed is connected by a transfer with a shed from the first pit which conveys the pipe to the heating ovens and test house and from the third to the fourth revolving table there is a similar arrangement, but the layout is reversed. The pipe runways consist of 70-pound rails supported by cast iron columns resting on concrete piers. The tar tank in each of the long sheds is served by a 6-ton electric traveling hoist which is used for immersing the pipe in the dipping tank. After the coating has become hard the pipe is subjected to a proof by hydrostatic pressure at 300 pounds per square inch. High pressure pipe is sometimes tested to 500 pounds per square inch, but as the limit in size of the pipe produced by this plant is 12 inches, no high service pipe will be cast. The varnish in the dipping tank is heated to a temperature of 300 degrees Fahr., and this is maintained at this temperature during the time the casting is immersed. In addition each casting is heated to a temperature of 300 degrees Fahr., immediately before it is dipped. The ovens in which the pipes are heated are so arranged that all portions of the casting are heated to an even temperature, and each casting remains in the dipping tank at least five minutes. Pipe for gas mains is, however, not given this coating.

Compressor Plant.

The compressor plant is located between the two short pipe cleaning sheds and, in additon to the air compressors contains the accumulators and hydraulic pumps. The compressors, which are equipped with Cutler-Hammer controllers, were installed by the Bury Compressor Co., Erie, Pa. The accumulators have a capacity of 600 pounds per square inch and each of the pumps is provided with an individual motor. The water tank adjoining the compressor house was built by the Riter-Conley Mfg. Co., Pittsburg, the tables having also been installed by this concern. The tank has a capacity for storing 15,000 gallons. The entire plant is electrically operated, power being furnished by the West Penn Electric Co. The entire equipment is driven by 65 motors, ranging in size from 1 to 100 horsepower, the total horsepower being 1,444.

THE INDICATED POWER AND MECHANICAL EFFICIENCY OF THE GAS ENGINE [1]

BY PROF. BERTRAM HOPKINSON [2]

In the report of the committee of the Institution of Civil Engineers on the efficiency of internal combustion engines, the following remark occurs:

"It would be desirable but for one circumstance to calculate the relative efficiency only from the indicator horsepower. But it appears that in the case of gas engines, and especially gas engines governed by hit-or-miss governors, the indicator diagrams do not give as accurate results as is generally supposed. The diagrams vary much more than those of a steam engine with a steady load, and the mean indicator horsepower, from the diagrams taken in a trial, may, it appears, differ a good deal from the real mean power."

This statement is fully borne out by the tests of the committee which show that the mechanical efficiency taken as the ratio of brake to indicated power varied from 80 per cent to 94 per cent in the three engines tested. These engines were of similar type, but of different sizes, and whereas the smallest, of 5 horsepower, showed a mechanical efficiency of 90 per cent the intermediate engine of 20 horsepower showed a lower efficiency of 80 per cent. The committee remarked that these values were obviously incorrect, and the values adopted by them for the mechanical efficiency were obtained by running the engine light and making an estimate of the indicated horsepower under these conditions. Assuming that the mechanical loss is constant at all loads, the indicated power at full load can be determined by adding the power absorbed at no load to the brake power. The mechanical efficiencies of the three engines found in this way were respectively:

Engine	L	R	X
Mechanical efficiency ...	0.86	0.866	0.888

These results are just what would be expected; the mechanical efficiency showing a slight improvement with the size of the engine.

The opinion of the committee quoted above is obviously important and may be expected to have a widespread effect in gas-engine testing. It throws doubt upon many of the efficiency tests on gas engines which have hitherto been made and published. Moreover, the method which the committee themselves adopted for getting the indicated power from the brake power seems to require further investigation before it can be accepted as accurate. It may, no doubt, be assumed on the evidence of steam engine tests that under given conditions of lubrication the friction is practically independent of the pressure in the engine. But whereas in the steam-engine the whole of the mechanical losses are to be ascribed to friction, that is not the case in the gas engine in which a considerable amount of power is wasted in pumping and is usually included in the mechanical losses. Moreover, with a given supply of oil, lubrication conditions in the steam engine are practically constant, but in the gas engine that is by no means the case. The author therefore determined to undertake an investigation with the

[1] A paper read before the Institution of Mechanical Engineers (England), Oct. 18, 1907.
[2] Cambridge University.

object of finding whether the indicator power of the gas engine does, in fact, vary so much and is so difficult of determination as the report of the committee suggests. If it were found that the indicated power could be accurately determined directly, it was further desired to test, by direct comparison of brake and indicated power, the validity of the committee's method of getting the mechanical efficiency. Briefly, the conclusions reached are:

(1) If precautions are taken to keep the pressure of the gas supply constant, the diagrams given by the engine are remarkably regular, and whether the engine be missing ignitions or not, it is possible, by the use of a sufficiently accurate indicator, to obtain the indicated power from diagrams within 1 or 2 per cent. It seems probable that the difficulty experienced by the committee was due either to the essential defects, for this purpose, of the ordinary form of indicator, or to casual variations in the gas supply per suction due perhaps to variation in the gas pressure at the engine.

(2) The difference between indicated horsepower and brake horsepower is rather less than the horsepower at no load under the same conditions of lubrication mainly because of the difference in the power absorbed in pumping. The friction is substantially constant from no load to full load, provided that the temperature of the cylinder walls is kept the same, but the influence of temperature is very great.

The engine used in the tests was intended to give a maximum output of 40 horsepower on the brake, and the following are its dimensions:

Cylinder diameter—11½ inches.
Cylinder stroke—21 inches.
Speed—180 revolutions per minute.
Compression space—407 cubic inches.
Compression ratio—6.37.
Compression pressure—175 pounds per square inch absolute.

When exploding every time, the indicated horsepower at 180 revolutions per minute is 0.495 times the mean effective pressure.

The engine works the ordinary "Otto" cycle, governed by hit-and-miss. The ignition is by magneto. The engine was loaded by belting it to a dynamo which also served to motor it round when required. The fuel used was Cambridge coal gas. When an accurate measurement of brake power was desired all-round rope brakes were used, one on each flywheel, and as the measurements were such that the brake-tests only lasted a few minutes it was not necessary to use any water cooling. The engine was fitted with an exhaust gas calorimeter of the spray type.

For measuring the gas supply a standard holder having a capacity of 10 cubic feet was placed between the main gas supply and the engine, and as close as possible to the latter. In the ordinary running of the engine the holder stood at a constant level, the flow of gas into it just balancing the flow out, and under these conditions it served as a gas bag, coming down by about 1/10 cubic foot at each suction of the engine. In a measurement of gas consumption the supply to the holder was cut off, so that the engine took gas only from the holder,

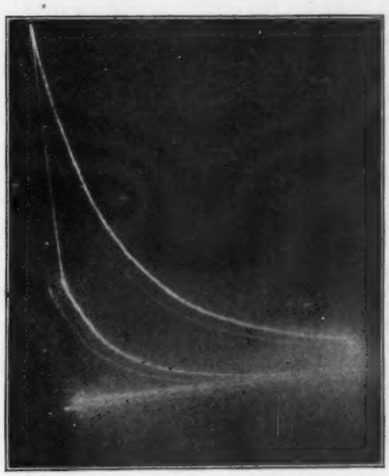


FIG. 1—FAC-SIMILE OF A NORMAL DIAGRAM, REPRESENTING ABOUT A DOZEN CONSECUTIVE EXPLOSIONS. TAKWITH INDICATOR IN FIG. 4.

and the quantity taken in a definite number of suctions (usually about 50) was noted. The indicator diagrams were photographed at the same time as this measurement was made. After the completion of the measurement the inlet pipe to the holder was opened and the counterweights adjusted so that the holder slowly rose to nearly its highest position, when the measurement could, if necessary, be repeated. It was possible in this way to read off the gas consumption correct to one part in 500, and, allowing for possible inaccuracies in the gas holder divisions, small changes in temperature and pressures, etc., it may be taken as certain that the gas consumption given is within ½ per cent of the truth. It was found that it made no perceptible difference to the power given by the engine whether the inlet pipe to the holder was open or closed, and it may be assumed therefore that the gas consumption remains the same under these two conditions. The rate of consumption determined by the holder may therefore be assumed to hold during the intervals when the holder is filling or is standing at a constant level.

It appears that on account of various disturbances, in themselves minute, gas engine diagrams taken with a pencil indicator cannot be relied upon as accurate to within 5 per cent, and the error must often be more like 10 per cent. When the indicator is subjected for any considerable time to the wear and tear involved in recording the explosions of a gas engine with high compression and using heavy charges its joints rapidly become so slack as to destroy its value for any but the roughest measurements.

To overcome both these defects of inertia and back lash it is necessary to reduce very much the motion of the moving parts of the indicator and to use optical means for magnifying that motion.. The author determined to get a new design of indicator of the piston and spring type with optical magnifying mechanism. The form finally adopted, after a considerable amount of experimenting, is described at the end of this paper. This instrument is practically indestructible, and it has been left open to the engine for considerable periods without giving it any attention. The vertical deflection is accurately proportional to the pressure, so that the diagrams can be integrated with a planimeter. Finally, the period of oscillation is only about 1/700 of a second with such strengths of spring as were used in the mechanical efficiency tests. The indicator is easily calibrated by dead weights. The diagrams used in these measurements were photographed, but for many purposes it has been found sufficient to observe them direct by means of a telescopic arrangement by which they are projected as a bright line of light on to a transparent screen with vertical and horizontal scales. It is easy to plot the diagram on to a piece of squared paper, and its area can thus be obtained within 5 per cent without the trouble of photography.

Fig. 1 is a fac-simile of a normal diagram taken with this instrument; it represents about a dozen consecutive explosions. In order to determine the accuracy with which the indicated power can be determined three diagrams similar to this were taken, each comprising 20 consecutive explosions, and these were integrated by separate observers directly from the negatives, each diagram being dealt with by two observers so as to get six independent integrations. In the result the mean of all the measurements was found to be 0.954, the

maximum being 0.963, and the minimum 0.940.

This test was considered to have established the accuracy of the instrument subject to the calibration being correct. It also proves that the diagram, when the engine is exploding continuously, is quite remarkably regular. It is certain that in a continuous series of, say, a hundred explosions the diagram area does not vary more than 1 per cent on either side of the mean value. When the governor cuts out charges of gas, however, a slight enlargement of the diagram is sometimes perceptible in the cycle following a miss. Occasionally this enlargement amounts to as much as 4 per cent, while at other times it disappears completely. On theoretical grounds it is to be expected that the gas taken after a miss will be, if anything, slightly less than after an explosion. On the other hand the efficiency is slightly higher. But whatever the cause of the slight difference in area, it is clear that it can have no practical effect in an ordinary full load trial, since it only happens once in five or six cycles. It may therefore be taken as definitely established that, given a sufficiently accurate indicator and constant conditions, the indicated horsepower of a gas engine may be determined from diagrams with an accuracy which is probably superior to that attainable in the steam engine.

The indicated horsepower of the engine is dependent, of course, upon the gas supply. In the tests described above the amount of gas taken per cycle was, no doubt, constant, but it is probable that under certain circumstances there may be casual variations of gas supply which give rise to varying diagrams. The gas taken per suction with a hit-and-miss governor is determined by the temperature of the cylinder walls and piston and by the opening of the gas cock. So long as these variables and the pressure in the mains are kept constant there is no reason why the gas consumption should vary. The mean pressure in the cylinder during the suction stroke is about 2 pounds per square inch below atmosphere, equivalent to about 55 inches of water. A variation of 2 or 3 inches of water in the pressure outside the engine, therefore, gives a substantial change in the gas supply. Such a variation would naturally occur after a missed ignition, if the gas bag were not of very ample capacity and placed close to the engine, and this may to some extent account for the very considerably enlarged diagrams which in some engines have been oserved to follow a miss.

Changes of cylinder temperature considerably modify the gas consumption per cycle with the same opening of the gas cock, but these changes are, of course, comparatively slow and do not affect the accuracy of an estimate of indicated power where the conditions are fairly constant. As an indication of their amount the following test may be cited. The engine was first run light with a large flow of jacket-water; it was then fully loaded and the jacket-water throttled until the temperature at exit rose to 185 degrees Fahrenheit. The load was then suddenly thrown off, and the engine was allowed to run light for a short time with the hot jacket. A large quantity of water was then passed through the jacket so that the temperature of the cylinder rapidly fell to 61 degrees Fahrenheit. The gas taken per suction was measured at intervals with the results shown in table I. The change in the gas consumption at and following the points marked * is mainly due to the change of temperature of the piston which very rapidly follows any change of load.

Definitions of the terms used in this paper follow.

Table I.—Effect of Changes Cylinder Temperature on Gas Consumption.

Jacket Temperature. (Outflow.) Degrees Fahr.	Load.	Gas. Cubic Feet per suction.
58-65	Nil.	0.1217
*72	Full.	0.1124
114	Do.	0.1103
185	Do.	0.1072
*196	Nil.	0.1117
185	Do.	0.1141
179	Do.	0.1159
61	Do.	0.1205

Indicated Power is the area of the positive loop of the indicator diagram multiplied by the number of explosions per minute and by the appropriate constant for reducing to horsepower.

Mechanical Loss is the difference between indicated power and the brake power delivered at the circumference of the fly wheels. It includes the negative loop of the working diagrams and also the negative work done when the engine takes no gas.

Mean Effective Pressure is the mean pressure calculated from the positive loop of the indicator diagram. It is sometimes convenient to speak of the "mean pressure effective on the brake," and this is equal to the *mean effective pressure* multiplied by the mechanical efficiency.

Mechanical Efficiency is, as usual, the ratio of brake to indicated power (the latter being defined as above).

Thermal Efficiency is the ratio of indicated power to the lower calorific value of the gas used, the two quantities being, of course, reduced to the same units.

A large number of tests were made with the object of determining the mechanical losses by finding the difference between indicated power and brake power, and of comparing the result with that obtained from running the engine light under the same conditions. It will be well to describe one of these tests in detail and to summarize the results of the others. The engine was run with a fairly full load, missing about one explosion in five cycles. The load was applied by means of rope brakes and, as the test only lasted a short time, it was unnecessary to employ any water cooling. While careful observations were taken of the brake load three photographs of indicator diagrams were taken, each photograph covering about a dozen explosions. At the same time the misses occurring in about a couple of hundred cycles were counted, so that the ratio of missed ignitions to cycles was accurately known. These observations gave all the data for the mechanical efficiency, no observation of speed being necessary; the speed was, however, kept approximately constant by the governor at 180 revolutions per minute, and in what follows brake power and indicated power are both calculated on the assumption that that was in fact the speed of the engine. The following are the results of measuring the three photographs together with the observations taken at the same time as the photographs:

Table II.—Determination of Horsepower.

Jacket: Exit Temperature.	Explosions Cycles.	M. E. P. from Diagram.	Gas per Suction.	I. H. P.	F. H. P.
150°F.(65°C.)	0.804	100.3	0.1196	39.7	34.0
—	0.82	99.4	0.1182	40.2	34.6
160°F.(71°C.)	0.825	99.0	0.1164	40.2	34.9

The gas charge was measured, as described above, by means of a standard holder, and is correct to within one part in two hundred. It will be seen that the mean pressures from the three diagrams show very good agreement, being all within 1 per cent of the mean value after allowing for the small change in gas charge. The mean of the three observations of brake horsepower is 34.5. The mean indicated power is 40.0, giving a mechanical efficiency of 86.2 per cent. The difference between brake and indicated horsepower ranges from 5.7 to 5.3 horsepower, the mean being 5.5 horsepower. In the course of the test the jacket temperature rose

slightly, and, as will shortly appear, this is sufficient to account for the small diminution in mechanical losses observed in the course of the test.

Immediately after the completion of the above full-load tests the brakes were taken off and the engine run without load, the jacket-water being throttled so as to prevent the engine from cooling down rapidly. Photographs were at once taken of the indicator diagram, the gas consumption was measured and the ratio of explosions to total cycles was ascertained to be 0.141. The mean pressure was found to be 105.5 pounds per square inch, the gas consumption 0.1252, giving an indicated horsepower 7.35, or about 1.85 horsepower more than the difference between the indicated horsepower and the brake horsepower in the full-load tests. Had the engine in the latter case been firing every time instead of four times out of five, this difference would have been increased in the ratio 5:4, becoming 2.3 horsepower.

This result, that is, that the power taken to turn the engine round at light load is rather over two horsepower more than the mechanical losses at full load, which was verified on many occasions, is due almost wholly to the difference in power absorbed by the pumping strokes of the engine at light load and at full load. This difference appears in Fig. 2 which shows the suction loop in the two cases. The full line is the diagram of a cycle in which no gas is taken, the dotted line shows the negative part of a diagram of a cycle in which gas is taken. It will be seen that, as usual in these engines, the exhaust line after an explosion is considerably lower than when the engine is simply exhausting a charge of air. Moreover, when the engine takes gas the pressure at the middle of the suction stroke is about a pound higher than when the engine is taking air only—no doubt because of the less restricted opening in the latter case. The mean pressure of the full load suction loop is 2.9 pounds per square inch, corresponding to 1.4 horsepower at 180 revolutions, whereas in the other case the pressure is 5 pounds per square inch, giving 2.5 horsepower. In addition to this a certain amount of work is done in the compression and expansion of the charge of air which occurs when no gas is admitted, the compression line being rather higher than the expansion line. It is difficult to show the whole of this work area on a diagram, because if the spring of the indicator is sufficiently stiff to take the maximum compression pressure of 170 pounds per square inch, it is hardly sufficiently sensitive to record the small difference of pressure between the expansion and compression strokes. From a good many observations of diagrams with different strengths of spring, however, and also from calculations based on the loss of heat during compression, it would appear that the mean pressure of this part of the diagram is certainly between 1.5 and 2.5 pounds per square inch. On this account, therefore, 1 horsepower must be added to the negative work done in each cycle in which no gas is taken, making approximately 3.5 horsepower at 180 revolutions per minute. This is 2.1 horsepower more than the power represented by the negative loop when the engine is firing every time, and is therefore just about sufficient to account for the difference between the full load mechanical loss and the light load indicated power.

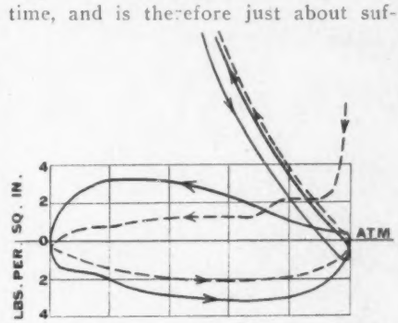


FIG. 2—LIGHT SPRING DIAGRAM, SHOWING POWER ABSORBED DURING LIGHT AND FULL LOADS.

Full Line Shows Diagram of a Cycle in which no Gas is Taken; Dotted Line Shows Negative Part of a Diagram of a Cycle in which Gas is Taken.

An independent estimate of the power lost in pumping was made by belting the engine to the dynamo and motoring it round without allowing it to take gas. Two measurements were made, one immediately after the other; in one the engine was closed up as usual; in the other the exhaust valve cover was removed so that there was no pressure in the cylinder. Assuming that the belt losses and friction losses are the same in the two cases, the difference between the powers absorbed by the dynamo (after deducting dynamo losses) should be equal to the power absorbed in pumping. Two tests gave the following results, the jacket temperature in both cases being 180 degrees Fahr.:

	Aug. 24.	Aug. 25.
Engine closed	7.72	7.1
Engine opened	4.14	3.77
Difference	3.58	3.33

The mean is 3.45 horsepower, against 3.5 horsepower estimated from indicator diagrams.

In comparing the mechanical loss with the light load indicated power, care was taken that the conditions of the engine as regards lubrication and cylinder temperature were as nearly as possible the same. It was found that these factors make a very great difference to the engine friction, and it is important to allow for this in basing any estimate of indicated power upon the power absorbed by the engine at light load.

Confirmation of the great variation of power absorbed with the condition of the cylinder was obtained by motoring the engine round. The exhaust valve cover was taken off the engine so that the cylinder was open to the air and there was no loss from pumping. The power taken to drive the dynamo was measured electrically, and the dynamo losses were deducted, so that the results given below are the total frictional losses in the engine plus the loss in the belt (probably about 0.5 horsepower):

Engine hot (about 180 degrees Fahrenheit, normal lubrication, power absorbed, 4 horsepower.

Engine cold (70 degrees Fahrenheit), normal lubrication, power absorbed 6.5 horsepower.

Engine cold (70 degrees Fahrenheit), excess of oil, power absorbed, 4.7 horsepower.

Engine cold (70 degrees Fahrenheit), water injected, power absorbed, 2.7 horsepower.

A separate determination of the power required to drive the engine round with the piston removed was made, and it was found to be 1.4 horsepower. This includes the main bearing friction, valve lifting and belt losses. If this be deducted from the figures given above the result is the piston friction, which, of course, is alone affected by the changes in cylinder temperature and lubrication. It will be seen that the piston friction varies according to conditions between 1.3 and 5.1 horsepower, the normal value with jacket at 180 degrees Fahr. being about 2.5 horsepower.

In normal working at nearly full load (41 indicated horsepower) with the jacket at 180 degrees Fahr. the mechanical losses in this engine may be allocated as follows:

Table III.—Mechanical Losses of Engine.

Suction	1.4 H.P.	3.4 p. c. of I.H.P.
Piston friction	2.5 H.P.	6.1 p. c. of I.H.P.
Other friction (valve lifting, etc.)	1.1 H.P.	2.7 p. c. of I.H.P.
Total	5.0 H.P.	12.2 p. c. of I.H.P.

The apportionment between piston friction and other friction is somewhat uncertain as it may be to some extent affected by the existence of pressures in the cylinder; the estimate of piston friction being based upon running the engine with the cylinder open to the air.

The effect of using water as a lubricant when the cylinder is cold is,

of course, easy to understand, though the author hardly expected to find that it was so great in amount. It is not quite so marked, though still quite perceptible, when the engine is running fully loaded. In one test, in which the engine was fully loaded and the jacket water at a temperature of about 180 degrees Fahr. at exit, it was found that injection of water in considerable quantity diminished the number of explosions per minute by about 3 per cent with the same brake load and speed. This difference is due entirely to the change of lubrication, the water having no effect whatever upon the indicator diagram.

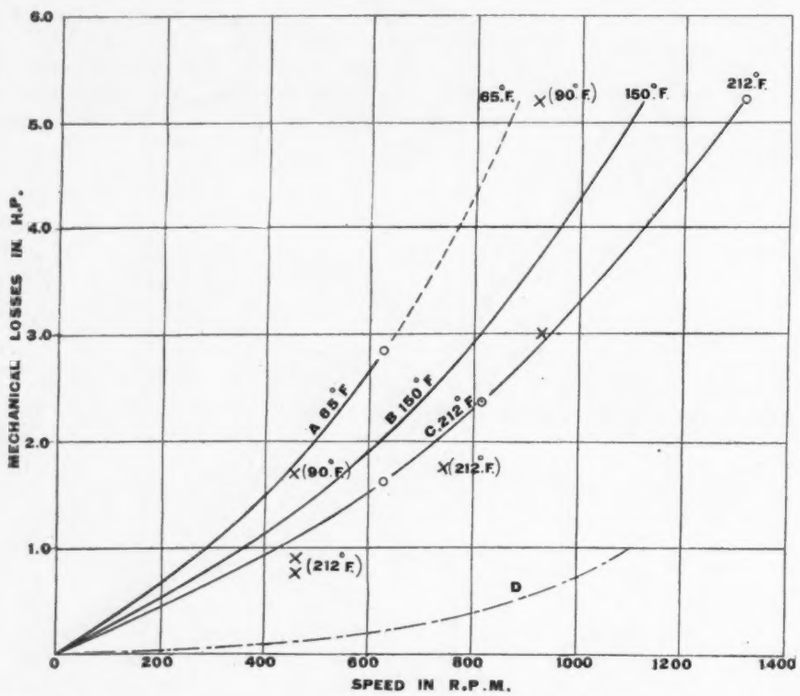


FIG. 3—MECHANICAL EFFICIENCY OF DAIMLER ENGINE WITH VARYING TEMPERATURE OF WATER JACKET.

Table IV gives the mechanical loss in this engine observed under different conditions. The lubrication is in each case normal, and the loss is the difference between the observed brake power and the indicated power. The engine was nearly fully loaded in every case, the proportion of idle cycles varying from 0.17 to 0.20.

Table IV.—Mechanical Losses in Engine.

Date.	Jacket Temperature, Degrees Fahr.	Loss, Horsepower.
Aug. 16, 1906	150-160	6.0
Aug. 22, 1906	185	5.0
Aug. 22, 1906	185	4.9
Jan. 31, 1907	69	7.1
Jan. 31, 1907	150-160	5.5
Jan. 31, 1907	203	4.5

The results show the effect of jacket temperature. The slight reduction in loss as between the August and January experiments is to be expected because the engine was run a good deal in the interval.

Table V is a summary of the various efficiency figures relating to this engine:

Table V.—Efficiency of Engine.

Thermal efficiency—33½ per cent to 37 per cent, according to strength of mixture.*
Mechanical efficiency for medium charge—85 per cent to 90 per cent, according to jacket temperature.
Air-cycle efficiency—52.2 per cent.
Efficiency relative to air cycle—0.64 to 0.71.
* The weaker mixtures give the higher efficiency. Full details of the tests establishing this fact will be given in a further communication.

It may be interesting in this connection to give the results of a series of tests for mechanical efficiency which were made upon a gas engine of a very different type; that is, a 4-cylinder petrol motor running up to 1,200 revolutions per minute. The engine was kindly lent to the author by the manufacturers, the Daimler Co., Ltd., and has cylinders 3.56 inches diameter with a stroke of 5.11 inches. The mechanical losses were determined by the method described by the author in a paper in *Engineering* (Feb. 8, 1907). The method consists in running one cylinder only of the engine and of indicating that cylinder, there being no load on the engine. The indicated power of the single cylinder is then equal to the mechanical friction of the engine plus the negative work shown on the diagrams of all the four cylinders. When the engine is running fully loaded at the same speed the loss by mechanical friction will be substantially unaltered, but the suction losses will not be quite the same owing to the same causes that operate in the case of the large gas engine. The suction loops in the three idle cylinders are different from that in the firing cylinder, and there is, moreover, the negative work done in the compression and expansion. The pumping losses, however, in the Diamler engine bear a very much smaller proportion to the whole than in the large gas engine, owing to the relatively great size of the ports, so that no serious error is involved in neglecting the difference in these losses as between firing and not firing. Fig. 3 shows the relation between the power indicated by the single cylinder and the speed for three different temperatures. In curve A the outlet temperature of the jacket water was 65 degrees Fahr., in curve B about 150 degrees Fahr., and in curve C the water was just boiling. The dotted curve D shows the power absorbed in pumping, estimated from light spring indicator diagrams; so that the difference between this curve and any one of the others gives an approximation to the loss by mechanical friction. These curves show that the frictional losses at a temperature of 65 degrees Fahr. are nearly double those when the jacket water is boiling. They also show that the losses increase very much more rapidly than in proportion to the speed, as is to be expected from the fact that they are due to fluid friction. These experiments were done for the author by Mr. L. G. E. Morse.

Mr. Morse devised another method of getting the mechanical efficiency of a multi-cylinder motor, which, as it is very simple and appears to be quite accurate, is worth giving here. It consists in running the engine loaded with all the cylinders working. The load is put on by means of a Prony brake clamped to the fly-wheel, carrying a dead weight which is partially supported by a spring balance having an open scale. The spring balance reads the excess of the dead weight over the brake load in the usual manner, and small changes in the brake load may be very accurately read. In making a test one cylinder is stopped from firing by cutting off the current, and the pressure on the brake-blocks is reduced until the speed has come up to its old value. The reduction in brake loads is then read off, and is approximately that corresponding to the indicated power of the cylinder which has been cut out. The four cylinders are treated in succession in this way,

and by adding the results the indicated power of the engine is determined. Points obtained by this method with the corresponding jacket temperatures are shown by crosses (×) on Fig. 3, and it will be seen that they agree very well with those obtained by indicating only one cylinder.

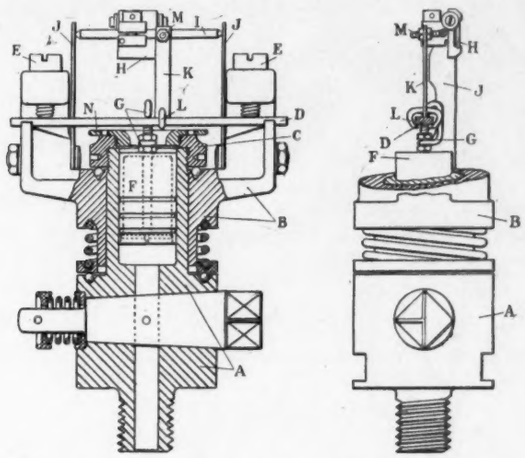


FIG. 4—INDICATOR USED IN THE EXPERIMENTS.

Description of Indicator.

Fig. 4 is a full-size drawing of the instrument, partly in section. The block A is screwed into the ordinary indicator hole of the engine. The frame B fits over the block, sufficient clearance being left to provide for unequal expansion. The frame is held up by a spring into engagement with the lower face of the nut C (screwed to the top of A), a ball race being interposed so as to admit of easy rotation of the frame about the axis of A.

The spring D is a piece of steel strip resting in grooves at the end of the frame B, and held by the screws E E. The spring is slightly bowed before insertion in the frame so that when the screws EE are screwed home, the spring is held straight with slight pressure on the four points of support.

The piston F slides in a bore in the block A. It is made hollow, but a plate closes to its lower end. At the top it is provided with a hook G, the opening of which is slightly larger than the thickness of the spring. The piston is thus free to move laterally, and no binding action is possible between it and the sides of the bore such as would occur if the piston were rigidly attached to the spring.

The mirror H is clamped to a steel spindle I, the ends of which are pivoted in small holes in the vertical spring cheeks JJ. The motion of the spring D is communicated to the spindle and mirror by means of the piece of vertical spring K. The lower end of this piece of spring is held firmly on the face of the main spring D by means of the jaws L; the upper end is firmly clamped to the arm M which projects at right angles from the mirror spindle.

The spring K, while sufficiently rigid to transmit the motion of the main spring to the end of the arm M without buckling, is flexible enough to allow for the angular motion of that arm. The mirror is thus turned about the axis of the spindle by an amount which is proportional to the displacement of the main spring D, and therefore to the pressure under the piston.

In order to give the other motion to the mirror the frame B is positively connected by linkage to a reciprocating part of the engine, and is thus caused to rock as a whole about the axis of the block A. The motion thus given to the frame B must be in phase with and proportional to the piston motion. In consequence of the smallness of the angular motion (about 1-16th of a radian) of the frame B, it is easy to secure this result with simple gearing, the effect of the curvature of the paths of the joints in the linkage being negligible. A convenient arrangement is that shown diagrammatically in Fig. 5, in which S is an eccentric fixed to the crank shaft, and such that the diameter is to the throw as the crank radius is to the length of the connecting rod. The lever W is jointed at one end to the rod V, which takes its motion from one end of a lever pivoted at the other end T, and engaging with the eccentric by a roller J. At the other end W is fixed to a clamping ring X, which fits over the turned portion of the frame of the indicator, Fig. 4.

The manner in which the diagrams are made visible is apparent from the diagram, Fig. 6.

The source of light is a fine hole P illuminated by an ordinary four-volt incandescent lamp. The rays from this, after reflection from the plane mirror of the indicator Q, fall upon the convex lens R_1, which is placed about 18 inches from the mirror and is 4 inches in diameter. The focal length of this lens is about equal to its distance from the mirror, and the beam of reflected light is therefore refracted to a direction about parallel with the axis of the lens. The

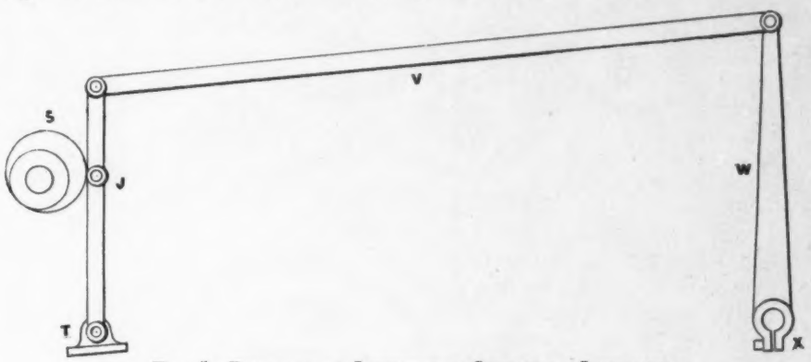


FIG. 5—DIAGRAM OF LEVERS FOR OPERATING INDICATOR.

beam comes to a focus in the plane R_2, and traces out in that plane the indicator diagram of the engine, the vertical displacements of the spot (corresponding to the tilting of the mirror about the spindle) being proportional to the pressure, and the horizontal displacements (corresponding to the rocking of the indicator frame) to the piston motion. With a sufficiently powerful source of light this diagram could be made visible by a ground glass screen placed in the plane R_2 but in order to render it visible with a small lamp, a trans-

FIG. 6—PATH OF LIGHT RAYS FROM INDICATOR.

parent screen is used and a second lens R_3 is interposed about 10 inches from R_2. This lens is of equal diameter with R_1, and refracts the beam of light (which before striking it is parallel to the axis) to its principal focus R_4 where the eye is placed. The beam is at the same time converted into a parallel beam, and the spot is seen sharply defined on the screen. The diagram traced by the spot is seen as a bright line of light The screen is engraved with horizontal and vertical lines, on which the diagram is projected. The pressure at any point can thus be easily read off, or the diagram can be plotted down on squared paper.

Three pistons are used, the areas being in the ratio of 1, 2 and 4. There are two springs, which are ground so that the stiffnesses are in the ratio of 1 to 5. A wide range of sensibility is thus obtained. The smaller pistons fit inside liners which are inserted in the bore of the block A, Fig. 4. The spring is very easily changed by slacking the screws EE and slipping the springs out together with the spindle and mirror, the spring cheeks JJ being slightly separated to allow of the spindle being taken out. When the spring has been removed the piston can also easily be taken out by removing the cap N, Fig. 4, which serves also as a stop to prevent excessive bending of the spring.

The indicator is very easily calibrated by dead-weights. The calibration is found to remain constant within 1 or 2 per cent, when the spring is removed and replaced. Suction pressures are registered on the same scale as those above atmosphere, on account of the slight initial set in the spring.

GENERAL ARRANGEMENT OF MANUFACTURING BUILDINGS[1]

BY OSCAR E. PERRIGO

In the earlier years of the history of manufacturing in this country the business was usually begun in a small way, not infrequently by the proprietor and one assistant or possibly a force whose number might be counted on the fingers. Such was the beginning of the enterprises started by such men as Walter A. Wood, Brown & Sharpe, William N. Whitely, (the "Reaper King."), B. F. Sturtevant, and others, who lived to see themselves surrounded by thousands of workmen, housed in manufacturing shops worth many thousands of dollars.

But in this progressive age there is no time for this slow development of the possibilities of a manufacturing business. We must keep pace with the march of progress or drop out of the race entirely. This is emphatically an age of ample and careful preparation, the employment of trained experts in their several special spheres of work, and all possible precautions are taken in investigating the subject in all its aspects and in carefully planning before the erection of a building is undertaken.

Every component part of a manufacturing plant must have a certain amount of earning power, whether it be the land, the buildings, the machines, or the workmen by whom the shops are manned. The money spent from the moment the land is purchased until the product of the plant is sold and shipped is an investment, and the success of the enterprise depends upon the earning power of the first cost of the plant and the expense of its maintenance. Thus an immense responsibility rests upon those charged with the preliminary investigation of the proposed enterprise in all its phases, and with the planning and equipping of the plant. In discharging the responsibilities imposed by this burden, mistakes and miscalculations are easily made, and they are much more far reaching in their effects than those made by the future manager of the works. His mistakes may usually be soon remedied, but those of the engineer who originally plans the works are liable to follow it as a burden of expense to the end.

From a superficial or casual observation of these matters it may be supposed that having decided to commence the manufacture of a certain product, as for instance a machine or a more or less well defined line of machines, and having organized a company for that purpose the several steps to be taken to inaugurate the processes of manufacture would be somewhat as follows:

First, to select the site for the purpose of manufacturing and purchase the land.

Second, to employ an architect and have him design the buildings and locate them.

Third, to construct the several buildings.

Fourth, to divide the buildings into the usual departments.

Fifth, to purchase the machinery for equipping the plant, and the pow-

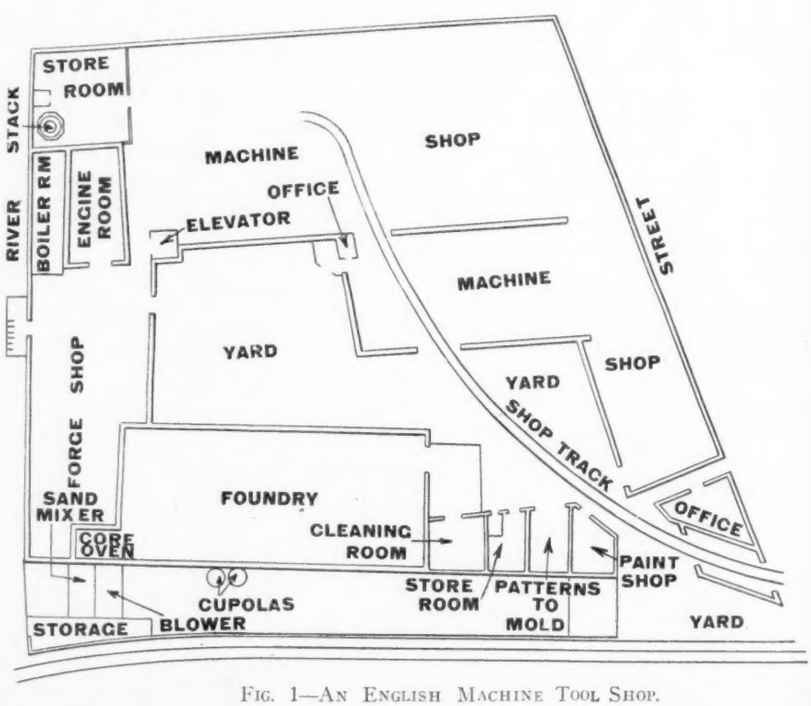


FIG. 1—AN ENGLISH MACHINE TOOL SHOP.

[1]Third of a series of articles on shop management and cost keeping.

er equipment for driving it, and to install this machinery.

Sixth, to start up the machinery, and from the drawings of the machines to be built commence their manufacture.

Seventh, as the experience of the progress of manufacture renders necessary, to formulate and revise the processes of manufacture, and to develop an economical set of machine operations, and the routing of the work through the several departments.

In a general way this might seem quite plausible to many manufacturers, and it is indeed very near the practice by which many industrial enterprises were commenced and developed years ago. But these methods have no place in the inauguration of manufacturing establishments in this hurrying age, and in the light of our present knowledge and methods it is very nearly wrong end foremost.

We should commence our investigations and our planning with the proposed product itself, because from first to last this is our objective; all else is but a means to an end. This view of the matter must be kept in mind and the theory of manufacturing the product carefully worked out before we begin to plan the buildings. The conditions so discovered and the operations and processes so determined must constantly be considered in designing and arranging the buildings and all else must be held in subordination to these conditions.

This does not mean, however, that we should build cheap and transient buildings, for this again would be losing sight of our objective. The first cost of the buildings is an expense once incurred and not repeated. It is an investment which should be an earning factor over and above the usual interest. If the buildings are well designed and built, the cost for maintenence will be comparatively a small percentage of their original cost. If they are poorly built, this cost will be a considerable and a continual expense. If they are poorly designed and arranged for the purposes for which they are intended, the inconvenience of administration, the routing of work and the transportation of material will be a still further constant expense, and it is not too much to say that these factors alone will sometimes defeat the commercial object of manufacturing, i. e., making a profit. By the false economy at the outset we save once, while we lose many times and continually.

In this article and those which have preceded it the purpose has not been to design buildings or to discuss the construction of them. The idea is to consider these matters only so far as their design and arrangement affect the questions of management and accounting, in the arrangement of departments, the routing of work, and the transportation of material; otherwise, in so far as they affect administrative features.

Neither is it the purpose to discuss the preliminary steps mentioned in the earlier part of this article as being necessary to lead up to the number, dimensions and arrangement of the buildings composing the plant. These preliminaries are supposed to have been made and the question brought up to the plan or location of the buildings with relations to each other, in order to form a complete and systematically arranged whole.

A manufacturing plant built in the midst of city buildings which crowd it on every side offers but scant interest in the study of the arrangement of the component parts of an industrial establishment, yet it is one in which much ingenuity must usually be exercised to furnish even passable accommodations for the proper conduct of the business. When confined to very limited areas they are usually those which commenced in a very moderate way, and in their development have been more or less the victims of circumstances. This is the case with the plant shown in the plan, Fig. 1, which began business about 40 years ago with less than half a dozen men, and which now employs upward of four hundred, which force has been provided for by the addition of two floors as well as a gradual extension of the original shop.

However, for administrative convenience it is well to arrange the buildings of the plant in compact form allowing only reasonable yard areas, but providing as far as possible for future extensions of the more important departments, as the machine

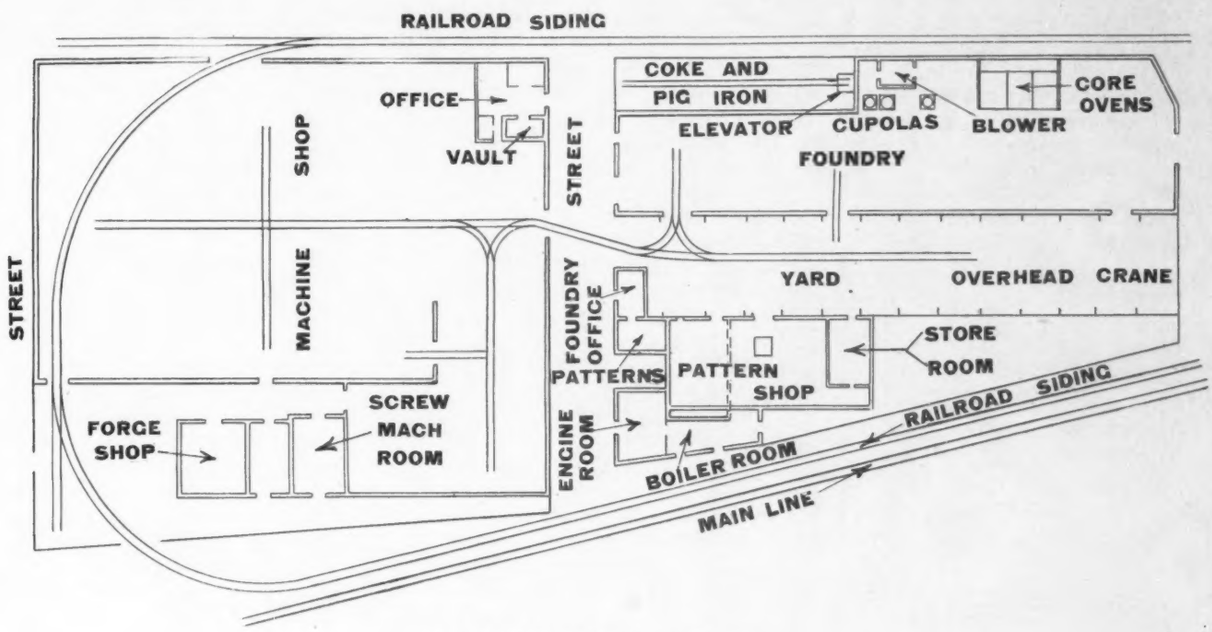


Fig. 2—Engine Building Plant.

shop and foundry. Simplicity should be a prime factor in the arrangement, and this should be sacrificed only when the conformation of the ground, or ease and economy of administration and transportation of raw material and work in process demand it.

At the same time it is not always advisable to arrange too many departments under one roof on account of the largely increased fire risk involved in this method. There is a growing opinion among industrial engineers that at even an increased cost for buildings it is wiser to erect a number of buildings, separated somewhat from each other so as to reduce the danger of fire, and to connect them by means of overhead traveling cranes, shop tracks, etc., for the convenience of moving material.

The plan shown in Fig. 2, is a good arrangement of large buildings, of which three cover all the departments, including the foundry, and which has been found in practice to be well adapted to the needs of the business. Transportation within the shops is principally by overhead traveling cranes, although the standard gage tracks shown are a very convenient adjunct and particularly useful in receiving and shipping. While these facilities are proper and advantageous when many large and heavy parts are handled, such facilities would need to be supplemented by narrow gage shop tracks and cars if the reverse were true and a great number of small parts were to be manufactured.

The plan of an agricultural implement manufactory is shown in Fig. 3. This plant was built about 1882 and is a good example of the arrangement of buildings of a large plant producing comparatively light but bulky machines in which a large amount of wood is used. An idea of the extent of the plant may be had when it is stated that the width at the front is 625 feet, and that the shipping building at the left is 1,000 feet long. The steel mill and the malleable iron foundry were erected several years later than the other buildings and at a time when the idea of broad buildings was receiving more attention than formerly. The latter building was 275 x 325 feet and capable of producing 30 tons of malleable iron castings per day. The gray iron foundry was of much older form, the main portion being used for the larger castings and the three wings for bench work. No castings were made large enough to require an overhead traveling crane. Yard transportation was entirely by cars on standard gage railway tracks, the concern having its own locomotive for that purpose. Fig. 4 is a perspective view of this plant. The original picture was an india ink drawing about 20 x 42 inches made by the author in 1886.

Fig. 5 shows the plans of a modern plant, arranged to handle heavy work. The three manufacturing buildings, A, B, C, comprising the machine shop proper, are arranged side by side, and across their rear ends is the erecting building, to which the work of these three shops is sent to be assembled. At the left of these and on the opposite side of an ample yard is the iron foundry, from the cleaning room of which runs a narrow gage track by which castings are delivered to all three of the manufacturing machine shop buildings. Narrow gage tracks connect with the various parts of the foundry and to the storage sheds at the rear. They are supplied from the railway tracks on the opposite side. The brass foundry is located at this end of the foundry and also connected by the narrow gage track system. In this yard is also the forge shop communicating by shop tracks with the machine shop buildings.

At the rear of the erecting building is the railroad siding by which the product is shipped, and which serves to bring in supplies for the foundry, machine shop, power house and other departments. These tracks are also extended across the front of the plant for the purpose of delivering supplies directly to the store house or to the front of the machine shop without the necessity of passing through the machine shops from the erecting building.

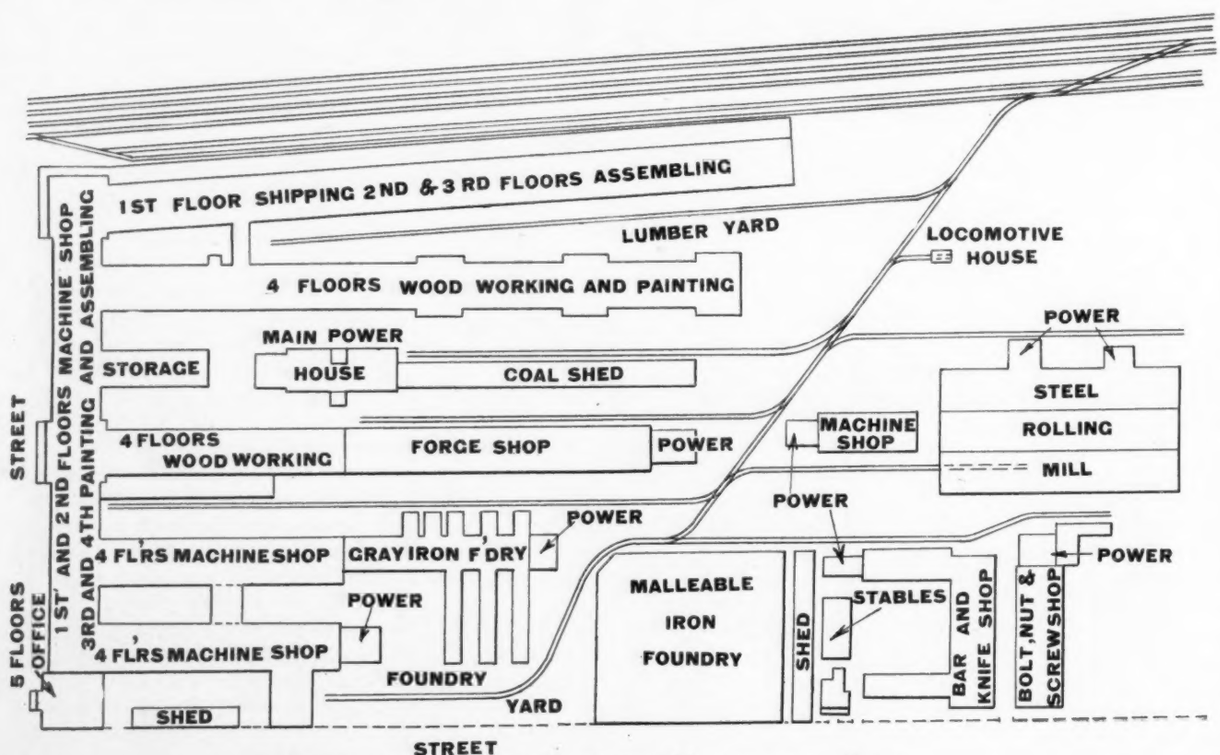


FIG. 3—AN AGRICULTURAL IMPLEMENT MANUFACTURING PLANT.

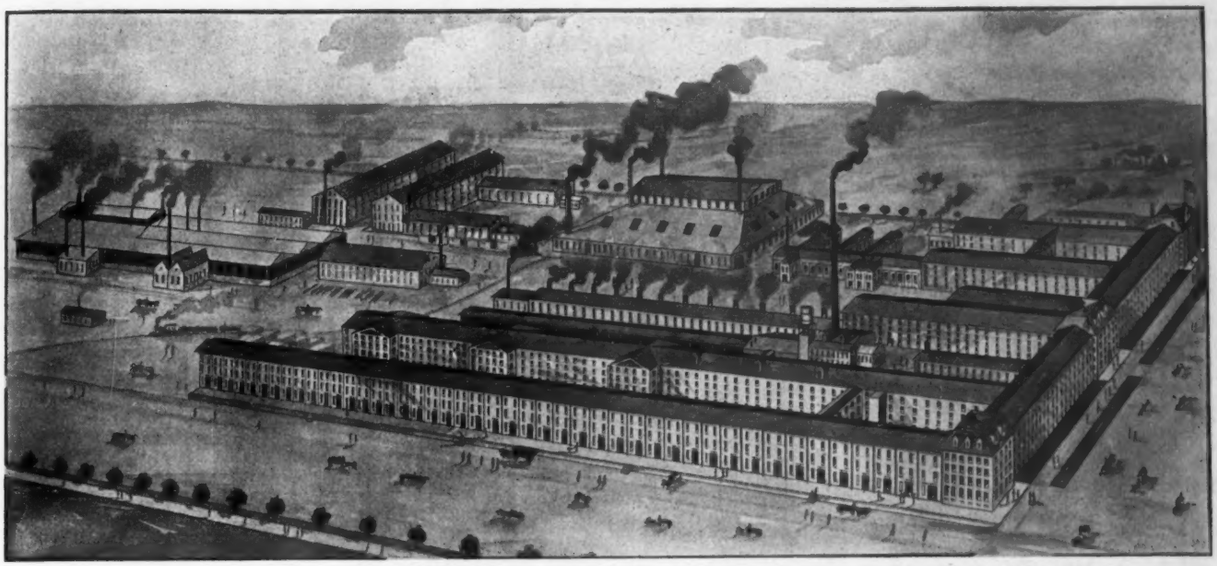


FIG. 4—PERSPECTIVE VIEW OF THE PLANT SHOWN IN FIG. 3.

At the center of the front of the plant is located the pattern building containing the store room and the pattern shop on the first floor and pattern storage on the floors above. The drafting room may be placed in this building, but preferably in the office building at the right. The location of the pattern building is convenient to the foundry by way of the flask room or carpenter shop, which is reached on the ground floor, or from the second floor by a bridge. Another bridge connects with the machine shop galleries, in case the drafting room is located in the building.

The office building is located in the center of the available space in front, but if the drafting room, or more properly in a plant of this extent, the engineering department, is placed in this building it would preferably be located nearer the pattern building and the second floors connected by a bridge.

The power house is located at the rear of the yard, bringing the boiler room convenient to the coal supply. With the greatly increased use of electricity for the transmission of power and the corresponding decrease in the use of shafting and belting for this purpose it is not necessary to locate the power house near the center of the shops requiring power, as was formerly the case.

In arranging the buildings of this plant the question of future extensions has been considered and provided for as shown by dotted lines. The three manufacturing buildings, A, B, C, in front, may be duplicated at the rear of the building, D, E, F, thus doubling the manufacturing capacity. Should there be need of enlarging the erecting space, the three buildings, G, H, J, may be erected and devoted to the manufacture of lighter parts or a smaller line of machinery which may be assembled in the building G. If, at the outset, there is a presumption that more erecting space will be needed for very large work, the power house should be located somewhat nearer the front, so as to provide for an extension of the erecting building 150 feet or more to the left without disarranging the general plan.

The foundry may be extended to the rear, as shown by dotted lines, so as to more than double its capacity, the storage sheds being re-arranged for that purpose and the system of narrow gage tracks extended through the new yard thus formed between the buildings, G, H, J, and the foundry extension.

In arranging the buildings in a plant as here shown, conditions as to the extent and form of the available space and railroad connections must of course be assumed. The principles by which the arrangement is made, will, however, remain the same, whatever the conditions may be, and

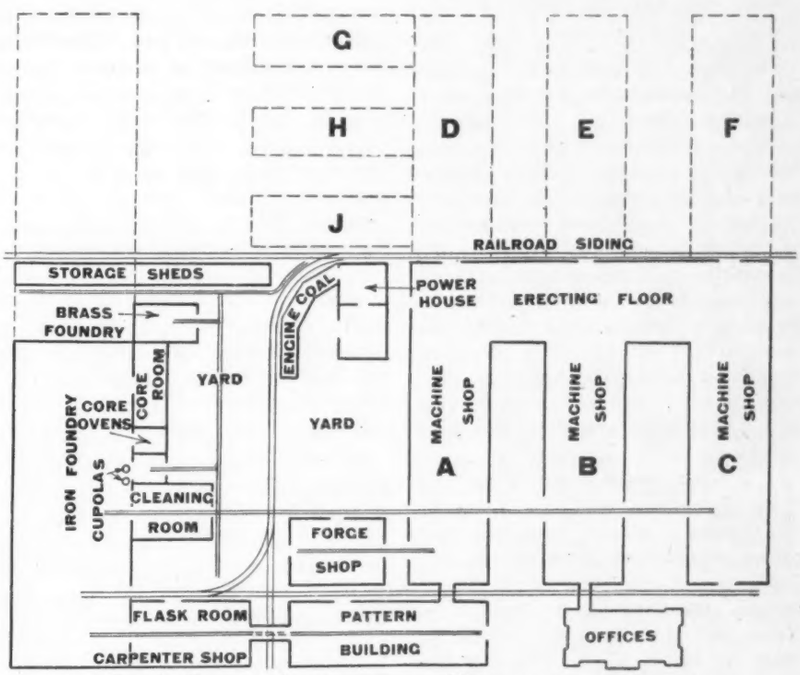


FIG. 5—GENERAL ARRANGEMENT OF MANUFACTURING BUILDINGS.

the object to be attained will ever remain constant; to so arrange the plant as to be best adapted to the manufacture of the particular product to be turned out, from the standpoint of administrative control, continuous and progressive routing of work, and ecenomy in the transportation of material.

LARGE HEATS IN OPEN-HEARTH STEEL FOUNDRIES.

Editor IRON TRADE REVIEW:

We note that on page 792 of the Nov. 14 issue of THE IRON TRADE REVIEW it is stated that from 50 to 100 molds from a 20-ton heat is the usual practice for open-hearth steel foundries.

We wish to say that our usual practice is from 200 molds and up per heat and we recently broke the record by making 275 molds from an 18-ton heat. Although some of these castings would weigh but 2 pounds apiece they would average about 60 pounds each, there being 580 pieces in the heat. It took 1 hour and 35 minutes to pour this heat and most of the castings in it were about ½-inch in thickness.

We feel that our plant in doing this demonstrates that with proper shop practice and furnace conditions it is possible to make a large number of pieces of medium weight castings with a 25-ton acid open-hearth furnace. We trust that this will interest you and your readers.

Yours truly,

W. A. RIDDELL,

Supt. National Foundry Co.

Erie, Pa., Nov. 20, 1907.

The Ball & Wood Co., Elizabethport, N. J., announces the addition to its engine business of a line of high grade air compressors of a new type, designed to meet the modern requirements for air compressing machinery equal in material and workmanship to the highest class of steam engine construction. These compressors combine important improvements in the air compressing elements of the machine. They are liberally designed, with large bearings and wearing surfaces, rigid frames, effective lubrication, ample valve areas and intercooling capacities.

Ph. Bonvillain and E. Ronceray, Philadelphia, report two important orders recently taken for their French molding machines, one from an important machine tool concern in Rhode Island and the other from an extensive electrical plant in the New England district.

SPECIFICATIONS FOR IRON AND STEEL[1]

BY DR. RICHARD MOLDENKE

Although one often hears of the fine castings produced by the numerous smaller foundries, where specifications and analysis for purchase and sale are disregarded, mention is seldom made of the carloads of castings rejected on account of excessive hardness or internal sponginess. These foundries generally employ standard material, which can be spoiled only through ignorance. In special lines of foundry work, however, and in the large jobbing shops, iron and other supplies are purchased under specification and are subjected to careful inspection.

Carbon.

A comparatively simple set of specifications for all foundry supplies—pig iron, fuel, fluxes and the newer ferro-alloys—will insure ample results. Since cast iron is primarily a steel with varying carbon content, carrying large amounts of impurities and mechanically mixed with graphite, it follows that a wide range of metal for casting purposes may be secured by varying the proportions of the impurities and of the combined and free carbon. Thus, a cast iron with but 0.20 per cent of combined carbon and near 4 per cent of graphite will really be a "twenty" carbon steel, the graphite merely causing the metal to act like cheese under the tool. The addition of steel scrap to the original mixture—thereby reducing the percentage of graphite without materially altering that of the combined carbon—strengthens the metal, which now, however, will not cut so readily under the tool. Proceeding further, an increase in combined carbon and a reduction in graphite, secured by reducing the silicon, will produce an "eighty" carbon steel, with so little lubrication for the tool as to be too expensive to machine.

In this way by varying the proportions of combined and free carbon, a wide range of metal is obtained, beginning with the soft, weak, easily machined black iron, rich in graphite, running through the gray and mottled grades, and ending in a hard, strong, white iron susceptible only to being ground.

Machinery and Malleable Castings.

Since the relative proportions of combined and free carbon may in a great measure be controlled through the silicon, it is generally sufficient to specify the maximum allowable percentages of sulphur, phosphorus and manganese. Normally blown irons, from reputable blast furnaces, run so uniform in carbon content as to render specification unnecessary. An "off cast" renders itself quickly apparent through the other impurities, and is sold only under its true designation.

For ordinary machinery castings (gray iron) the pig iron used as part of the charge should contain:

Sulphur, not more than.....0.05 per cent
Phosphorus, not more than...0.50 per cent
Manganese, not more than....0.80 per cent
Silicon, from 1.75 per cent to 2.75 per cent, as specified.

For malleable castings (white iron) the pig iron used should contain:

Sulphur, not more than.....0.04 per cent
Phosphorus, not more than..0.225 per cent
Manganese, not more than...0.60 per cent
Silicon, from 75 per cent to 1.50 per cent, as specified.

A variation of 10 per cent, either way, from the above figures may be allowed.

Light Castings.

Where light castings are desired, as for stoves and art work, the phosphorus is specified at 1.00 per cent and over, and the silicon often as high as 3.25 per cent. Similar specifications may be prepared to cover the rest of the 13 rather distinct grades of cast iron, with their more than 40 variations.

To enable foundrymen unacquainted with the metallurgy of cast iron to buy intelligently, the American Society for Testing Materials, through its committee on specifications for foundry iron, prepared schedules designating the composition of the very deceptive but well known, old grade numbers. Thus Nos. 1, 2, 3 and 4 are to contain 2.75, 2.25, 1.75 and 1.25 per cent of silicon, respectively, fracture appearances being disregarded. Sulphur is specified at less than 0.035, 0.045, 0.055 and 0.065 per cent, respectively, when estimated volumetrically, with an allowance of one hundredth more in case the gravimetric method is employed. A variation of 10 per cent of silicon, either way, from the above figures is allowed; and the sulphur may vary 0.02 per cent. A deficiency of over 10 and under 20 per cent does not lead to rejection, but entails a penalty of 4 per cent in price. This is eminently fair, and protects manufacturer and foundryman alike.

In sampling, each car is taken as a unit, and from this one pig is selected out of each four tons. In case of dispute, a pig is selected from each two tons, the loser paying for the additional labor caused by the closer sampling. Drillings from these pigs taken so as to fairly represent the fracture surface, are to be well mixed before analysis.

[1]A paper presented at the New York (Dec., 1907) meeting of the American Society of Mechanical Engineers.

It is interesting to note that the liberality of these specifications, appealing as it does to the conservatives, is in direct contrast to the severer requirements of the foundryman who buys by specifications of his own.

Fuel for Foundry Work.

Ordinary foundry operations require as fuel anthracite, coke and soft coal, while producer gas, natural gas and oil are employed in the special brass furnaces and the open-hearth for steel and high grade iron. Necessity for specification is confined to bituminous coal and coke, and in the case of the former only the sulphur, and occasionally the ash, demands attention. The increasing use of the air furnace for the manufacture of high grade engine castings is leading to a study of the availability of various soft coals; and the United States geological survey, through its advisory board on fuels and structural materials, has gathered much information, so that specifications for coal and coke for melting purposes may be expected soon. In the meantime, it may be stated that no coal containing more than 2 per cent of sulphur should be used in the foundry, and, preferably, the amount of this impurity should be limited to 1 per cent. Similarly, the ash should be limited to 10 per cent.

Coke.

The employment of coke demands closer attention to moisture, to the remaining volatile matter, fixed carbon, sulphur, ash and sometimes phosphorus. Usually, however, the sulphur, ash and fixed carbon are sufficient to give a fair idea of the value of coke, apart from its physical structure, specific gravity, etc. The advent of by-product coke will necessitate closer attention to moisture. Bee-hive coke, when shipped in open cars where it absorbs much moisture, may, through inattention, cause the purchase of from 6 to 10 per cent of water at coke prices.

Concerning sulphur, there is much to be ascertained; whether its sulphates or its volatile compounds get into the iron, and how. Foundry practice, however, has recognized the fact that a very hot running of the cupola results in less sulphur in the iron. In good coke, the amount of sulphur should not exceed 1.2 per cent; but, unfortunately, the percentage often runs as high as 2.00. If the coke has a good structure, an average specific gravity, not over 11 per cent of ash and over 86 per cent of fixed carbon, it does not matter much whether it be of the "72-hour" or "24-hour" variety. Departure from the normal composition of a coke of any particular region should place the foundryman on his guard at once, and sometimes the plentiful use of limestone at the right moment may save many castings.

Limestone to be used for fluxing should be as rich as possible in carbonate of lime, for each unit of silica transformed into slag exacts its equivalent of lime and coke. Oyster shells form a most desirable flux, and fluorspar tends to thin the slag.

Ferro-Alloys.

Use of the modern ferro-alloys will eventually be limited to the richer grades. Even today 80 per cent ferromanganese is demanded; and, while 50 per cent ferro-silicon is much used, the 75 per cent grade, or better, is specified by the wide awake foundryman. It is wasteful to employ a rich alloy in the cupola; but in the ladle, removed from the further application of heat, the smaller bulk of the richer alloy causes a smaller reduction in the temperature of the molten iron. For the present, specifications are not required for these alloys, which are made from the best material, and should be low in the undesirable elements, sulphur and phosphorus.

Scrap.

In selecting scrap iron, each foundryman chooses wornout or broken castings similar in composition to the proposed product, so that the addition of this scrap to the pig iron mixture does not disturb the calculations.

Beyond the exclusion of burnt or very dirty metal, and of sizes so small as to cause waste in melting or too large to enter the charging door, specifications for scrap iron should be limited to a statement of the class of material wanted—machinery, malleable wheels, pipe, etc.

Weak castings and castings with pin holes or with pockets under the skin, are indicative of the use of burnt metal. Three hundredths of 1 per cent of oxygen in solution in the iron as an oxide or combination of oxides is, in the case of white irons, sufficient to ruin them completely. The excessive "skulling" of ladles, and other troubles, can be traced to this cause. Thus oxygen in cast iron is far more powerful than even sulphur; yet the action of the former is little understood and does not lend itself readily to chemical investigation.

Molding Sand.

In the matter of molding sands, American foundry practice is far behind that of Germany, or of the rest of Europe. Until the price of our sands has advanced considerably, we shall continue to wet down and mix with a shovel, instead of grinding and sifting and tempering by mechanical means, as in foreign practice. Careful preparation of the sand before it goes to the molding floors will insure castings free from surface blemishes. Under present American conditions, attempts to introduce specifications for molding sands are of doubtful value.

Steel Foundry Conditions.

The absolute necessity, in the case of a successfully operated steel foundry, for the application of specification to all supplies purchased is so well understood that the steel foundry is usually classed with the steel mill, and apart from the foundry. If the acid process is used, or the Bessemer converter, the metal used is a "fancy" pig iron containing practically only iron, carbon, and the proper manganese and silicon. The basic process allows the use of cheaper material.

The characteristics of the finished product are determined either by testing each article, or by testing to destruction an occasional sample, or by the use of test bars.

If the establishment makes finished specialties in iron, ease in machining is the important requirement, and an estimate of this quality may be gained by placing an occasional cast sample disc in the lathe or drill press, the nature of the tests being dictated by the experience of each shop.

Commercial Castings.

Ordinary commercial castings, on the other hand, must be subjected to additional tests; boiler sections, to determine their resistance to pressure; valves, to ascertain whether they are tight or not. Castings produced in very large quantity must be tested to destruction, by sample, which of course, is far beyond the limits of actual service conditions. The remarkable quality of car wheels has resulted from this exacting system of testing.

The foundryman, however competent, is dependent upon the quality of the iron, for the production of serviceable castings. It is necessary, therefore, in the many cases to which testing to destruction is inapplicable to make a test of a sample form composed of iron identical with that in the casting. Today in foundry practice the foundryman may employ shop test bars of such size and shape as he chooses. Comparison of the performance of his test bar with that of

the purchaser's test bar will enable the experienced foundryman to determine the degree of exactness with which he is meeting the requirements.

Standard Tests.

Finding that such a variety of standards prevailed, the American Foundryman's Association and the American Society for Testing Materials, under separate action, but by individual members of each committee, have adopted a set of specifications which embodies the last word on this complex subject. These specifications depart entirely from established procedure.

It has been attempted in these specifications to avoid the introduction of outside influences as far as practicable, and to have the sample represent accurately the iron as it comes from the cupola or the furnace. Hence, the round sample bar is to be of as large size as the limits of commercial testing machines will permit, it is to be poured in a vertical position, to avoid the difference of strength between top and bottom, if poured horizontally; and the mold is to be dried, to ward off the effect of damp sand. The speed of testing is specified, and a regular routine of pouring is to be observed. At the suggestion of Mr. Walter Wood, this bar is called the "arbitration bar," as it is intended for use only in case of dispute between buyer and seller.

The new method of testing, as adopted by the American Society for Testing Materials, is being generally used, and is found to be far superior to the old custom of flat, square bars of small cross section, or the long bars so susceptible of dishonest manipulation. The transverse is best suited to the peculiar nature of cast iron; but an optional tensile test is provided for, at the cost of the party demanding it, although in Germany this latter test is excluded altogether. For further details, the reader is referred to the publications of the two societies mentioned heretofore.

Metallurgy.

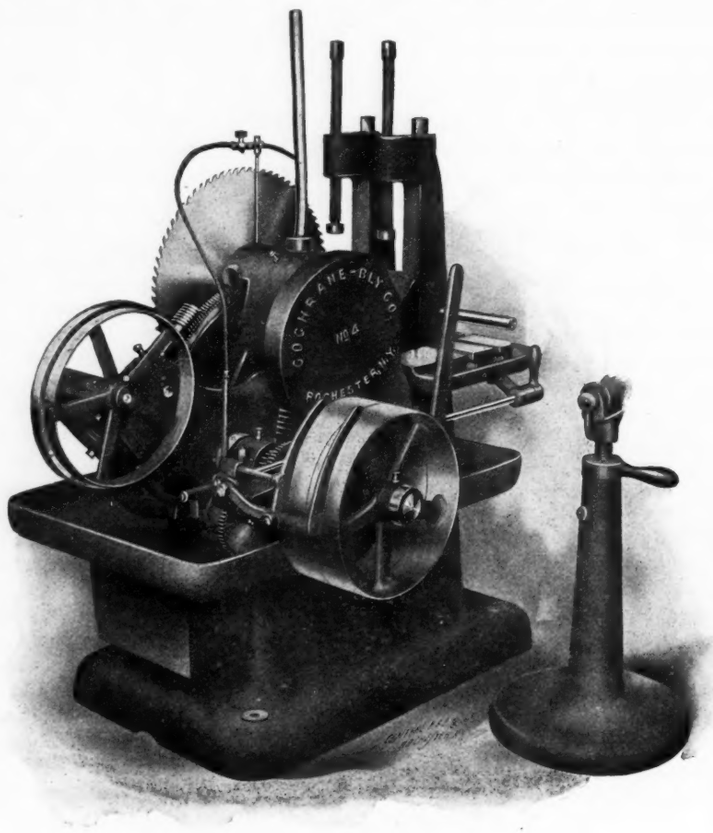
The ethics of the cast iron industry has been dependent upon the better understanding of its metallurgy. In times past the foundrymen refused orders to which specifications were attached; and he refused even to provide tentative specifications which might enable the buyer to obtain such iron as he desired to purchase. Now this is changed, and the progressive foundryman welcomes inspection of his methods and tests of his product.

It is to the lasting credit of the foundry that the first demand for specifications came from the foundrymen themselves, through their association, and that they co-operated heartily with the engineer by furnishing information, freely and without reserve. A very friendly feeling between buyer and seller has ensued; for no better evidence of good faith can be given than an invitation to visit freely the shops and the laboratory to inspect manufacture and test. This is the rule today, not the exception.

A NEW METAL SAWING MACHINE.

The accompanying illustration shows the Cochrane-Bly No. 4 metal sawing machine built by the Cochrane-Bly Co., Rochester, N. Y. This machine is designed on the same lines as earlier machines built by this company, and is intended for cutting rapidly and accurately bar stock of all sizes up to 6 inches round, 5½ inches square, and also I-beams up to 12 inches, channels, angles, etc. The machine is spur gear driven, the saw spindle being carried on the swinging carriage which takes all the strain of cutting. It has been made large and heavy, thus insuring rigidity. The driving gears are cut and the pinions are of hardened steel with ground shafts. The carriage is strongly pivoted to the bed and is fed into the stock by the feed screw, which engages a segment of the worm wheel on the carriage. This feed screw is driven by a worm gear belted to a cone pulley on the driving shaft, which gives two feeds. It is thrown into mesh with the worm wheel by a hand-lever and is held there by a pawl.

An adjustable automatic stop may be set to release the pawl when the cut is finished and a spring disengages the feed screw, thus stopping the feed at any point in the travel of the carriage. Lubrication is accomplished by means of the oil pump supplying the blade with oil from a reservoir and a large drip pan, which surrounds the bed, provides for chips and oil drainage. The vise is designed to hold 6-inch round or square stock and other shapes. The large table provided with movable clamps allows the making of angular cuts.



COCHRANE-BLY NO. 4 METAL SAW.

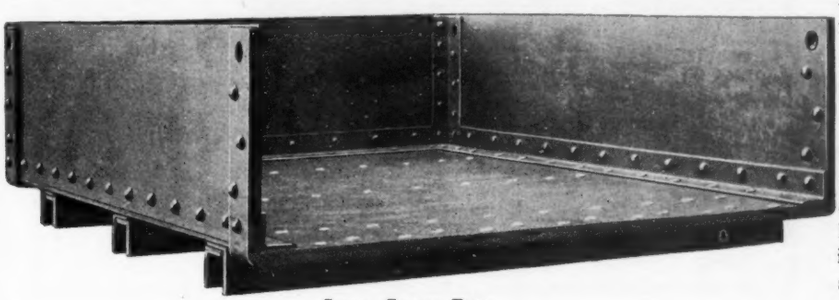
The company made a number of tests on the first machine of this size built, with satisfactory results. It was found that it was entirely practicable to cut 4¾-inch, 0.35 carbon open-

hearth machinery steel in six minutes per cut. The machine was run for a considerable period at this rate and over 150 cuts were made with one blade with one sharpening. The following table shows the principal dimensions of the machine:

Capacity:	
Round bars	6 inches
Square bars	5¼ inches
I-beams and rectangular sections	5½ x 12 inches
Saw Blade:	
Diameter	18 inches
Thickness	5/32 inch
Saw Arbor:	
Diameter	3¼ inches
Saw Collars:	
Diameter	5 inches
Work Table:	
Dimensions	15 x 18 inches
Height, from floor	25 inches
Height of vise from floor	28 inches
Floor space	30 x 43 inches
Weight	1,250 pounds

STEEL GROUT BOXES.

The accompanying illustration shows a steel grout box made by the Republic Structural Iron Works, Cleveland. These are for derrick use at quarries and on general contracting work. They are much lighter than wooden boxes and are practically indestructible. They can easily be made in various designs to suit varied conditions. The bottom and side plates are reinforced by two straps of bar steel ¾ x 4 inches and the bottom is further strengthened by three sets of double angles, each 3½ x 3½ x ½ inches inside of 4 x 4 x ½ inches, a single line of rivets passing through the angles and bottom plate. Two hoist holes are provided, each 1¾ inches diameter, through 1⅛ inches



Steel Grout Box.

of steel. They are centered two inches from the top and ends of the box and pass through the reinforcing straps and side plates. The outside dimensions of the box shown are 5 feet 6 inches by 1 foot 6 inches, and it is composed of four ⅜-inch open-hearth steel plates, the sides and bottom being riveted to 3 x 3 x ⅜-inch steel angles.

The Soo Railroad Co. is about to begin the construction of a large two-story brick addition to its machine shop at Minneapolis.

A NEW PORTABLE VISE STAND.

In nearly every manufacturing plant, no matter what may be the character of the product, there is continually arising the need for a portable work bench or vise stand, which may be easily moved from one place to another, in order to save the workman time in the prosecution of his task.

This need prompted the design of the "New Britain" portable vise stand, built by the New Britain Machine Co., New Britain, Conn., and the maker has endeavored to incorporate in the design the many features that are needful, and yet supply a combination that shall be pleasing to the eye.

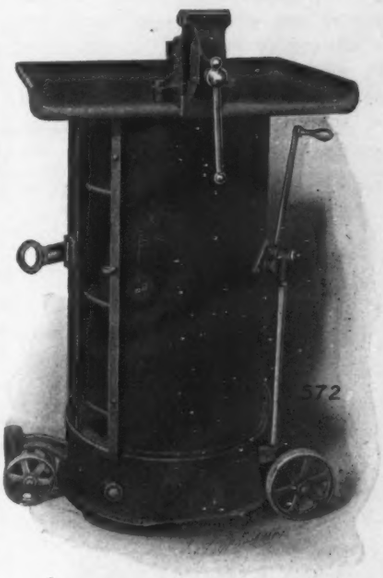
A circular column of rolled boiler plate, firmly held between the base and the top, provides the necessary stiffness. This method of construction gives far greater rigidity than is possible by any arrangement of shelves, and it successfully withstands the hammer blows in chipping. The top, of cast iron, is so shaped that tools or work may be laid upon it, and in moving from place to place they will not jar off.

The interior of the column is provided with three beaded edge shelves (two of which are adjustable) for the storage of tools, and the sliding door with a hasp fastening closes the column. This door sets into jambs, travels in slides top and bottom, and when fastened with a good padlock gives proof against pilfering. Then too, the relation of the door to the vise is such that it is easy to open the door to disclose the contents without the workman moving from the working position, and the column is not weakened under the vise.

The base, strongly constructed of cast iron, gives ample spread for floor support, and on the vise side is far enough back from the working line so that in standing at the vise nothing is in the way of the workman's feet.

By a clever device, arrangements are provided so that no help is required for transporting the bench from one place to another. It is only necessary to raise the self locking handle to the position shown in the illustration, to bring the stand off the floor and to bear upon its three wheels, two of which are dead and one on swivel. The stand can then be easily pushed over rough or smooth floors, the swivel behind, and when the desired point is reached, a depression of the lever drops it upon its base, and it is ready for use. Should occasion require, the stand may be worked up into a corner.

The stand is built in two sizes in one of which the top tray is 20 x 26 inches,



New Britain Portable Vise Stand.

carrying a 3½-inch vise. In the other the top tray is 24 x 32 inches, carrying 5-inch vise. In each case, the vise is just the right height for filing, 41 inches.

THE "PILOT" IRON BODY GATE VALVE.

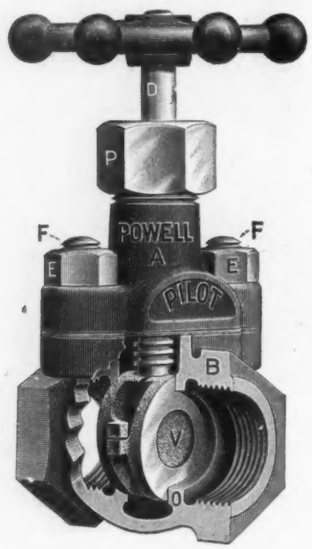
The accompanying illustration shows the "Pilot" iron body gate valve, a new addition to the line of steam specialties manufactured by the William Powell Co., Cincinnati. The iron body is designed with heavy lugs on either side of the neck carrying stud bolts F. The bonnet cap A has corresponding lugs, which are drilled to templates, thus insuring a perfect joint and alignment at all times. This also allows the bonnet to be replaced without unusual care in dissembling for inspection or repairs. Two semi-finished hexagon nuts E of large sizes, together with a joint of good packing material between the faces and body make a tight joint for all pressures up to 100 pounds.

A large brass packing nut P permits ample room for packing to prevent leakage around the stem. The brass stem D and the bonnet are chased and cut to a thread of un-

usual length, the long thread keeping the stem in a true axial position at all times whether open or closed. The hand wheel is provided with knobs, giving a firm grip even to oily hands.

The valve discs V are double wedges with a ball and socket back making them adjustable. They are hung in recesses in the collar on the bottom of the stem and work in a tapering seat expanding or collapsing when opening or closing, giving a valve closed down tight without straining and which opens easily under all conditions.

In addition to the valve described above, this gate valve is also made of iron, that is, discs, stem and packing



POWELL "PILOT" GATE VALVE.

nut are of iron, not a particle of brass being used in the construction. This type of valve will be found especially valuable in controlling ammonia, cyanide solutions, acids and all other liquids that attack brass.

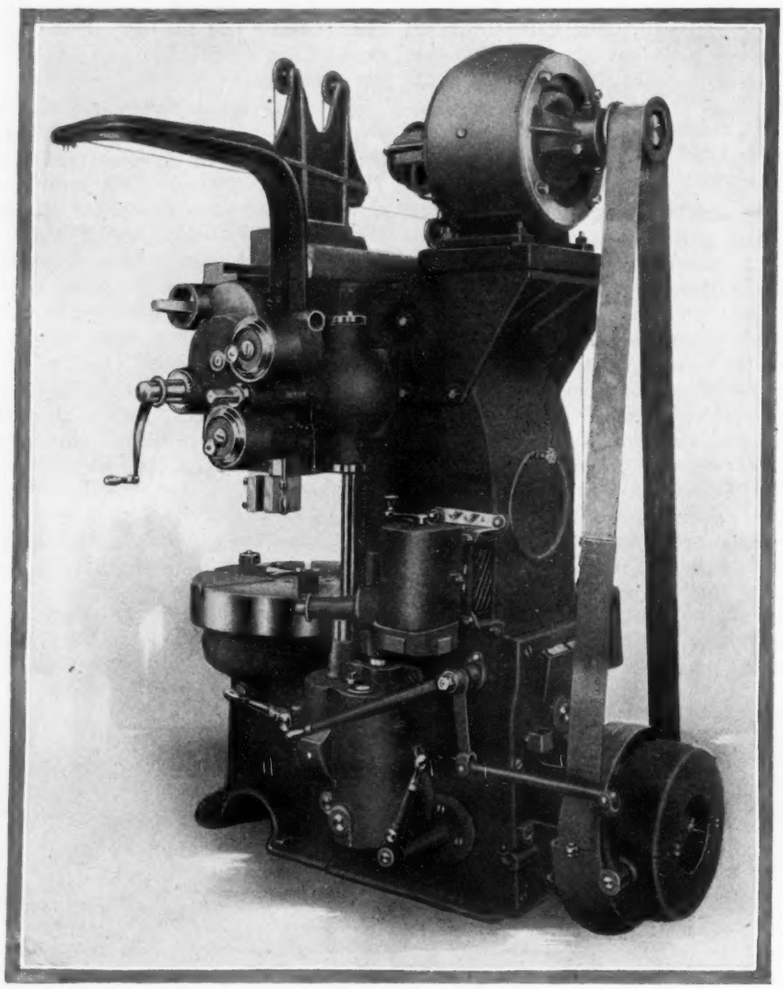
Plan Overhead Crossing.—The city council of Columbus, O., has passed the ordinance providing for the $1,000,000 bond issue for the elimination of all grade crossings. The bond issue was approved at the recent election by a vote of 21,719 to 6,170. The Hocking Valley, T. & O. C., B. & O., and other roads entering the city will be carried over streets on steel and cement overhead crossings.

The Traylor Engineering Co., 58 Trinity place, New York city, has established a Denver branch office by appointing the Newbury Machinery Co., Century building, of that city, its representative in the Colorado district.

MOTOR DRIVE ON GISHOLT BORING MILL.

The boring and turning mill here shown is a product of the Gisholt Machine Co., Madison, Wis., and the form of motor drive is one of the latest brought out by this company. The motor is a 5-horsepower, variable speed, with a speed ratio of 4:1 and a speed range of from 400 to 1,600 revolutions per minute. On this form of drive a single friction pulley controlled by a lever, as shown, is substituted for the three step cone pulley used on the belt driven machine. Through the friction device provided on the motor driven machine the table is under the absolute control of the operator and may be started, stopped or moved any fractional part of a revolution. Owing to the position of the motor as mounted no additional floor space is required, the machine being self-contained.

This machine is provided with 8 feeds, gear driven, and is equipped with a friction device reducing to a minimum the possibility of stripping gears through careless handling. The machine also has micrometer index dials reading to 0.001 inch on all feed screws, by means of which the tool in the turret may be moved 0.001 inch or more in any direction without the use of a scale. By means of the feed tripping device any feed may be positively or automatically stopped at any predetermined point. The dials for controlling the feed trip may be plainly seen at the end of the cross rail. This device will also trip any feed positively at either end of the feed traverse whether the dials are set or not. The machine may be fitted with either a plain table or a chuck and has an extreme swing of 36½ inches.



MOTOR DRIVE FOR GISHOLT BORING MILL.

Orders have been placed by the Hocking Valley Railway Co. with the American Locomotive Co. for 10 switch engines and two passenger engines to be delivered in 1908.

Stocks Hold Stronger Position.

Genuine improvement in the financial situation and in the strength of securities characterized the developments of the past week. Confidence appears to be gradually returning and sentiment has shown a change for the better, although as to the stock market's immediate future, there is a variance of opinion. The gradual return of the money market to a normal basis was evidenced during the week in the steady decline of the premium on currency. The maximum premium in the period under review reached only 2½ per cent, against 3½ per cent the previous week, and on Friday and Saturday engagements fell as low as ½ per cent. Imports of gold, for which, under force of necessity, liberal inducements were paid, are falling off. Secretary Cortelyou has also announced that in view of the relief of the acute conditions prevailing, no further subscriptions will be received for the 3 per cent treasury certificates. The total issue of the authorized amount of $100,000,000 of these certificates will probably not exceed $35,000.000. It is expected, however, that the full $50,000,000 issue of Panama bonds will be marketed. Hoarded currency is returning to the banks, and in many localities preparations are being made, looking toward the resumption of cash payment. It is believed, however, that the real test of the situation will come when the banks are finally again on a cash paying basis. If this condition is not followed by large withdrawals of cash, it is held that the practical end of the panic will be indicated. The money market ruled easier during the week, although on Friday call rates went to 14 per cent, the week's maximum, against 15 per cent the previous week. Time money quotations were mainly nominal, although rates declined and offerings slightly increased. In securities both stocks and bonds have gained in price, and some good buying has resulted. The covering of short interests has contributed to this improvement, and it is believed that there is a considerable short party still outstanding. While there was some liquidation throughout the week, general selling of this character was not much in evidence after Monday, and the week closed with a stronger tone ruling in the market. The New York associated bank statement was the best issued since the present financial stringency has made itself felt. For the first time since the middle of October an increase in the net reserves was shown. This gain amounted to $1,114,175, and brought the deficit in the reserve to $52,989,425, corresponding to a surplus of $1,449,125 on Dec. 1, 1906. The cash gain was $1,980,300, and the increase in deposits $3,464,500. The expansion of loans reached $10,080,100, and the circulation was increased by $2,862,400, making a total of $62,129,800, the largest New York banks have ever had outstanding. The total loans of the New York banks are now about $115,000,000 in excess of deposits. A year ago the excess was about $50,000,000.

THE LEADING INDUSTRIAL SECURITIES.

	Clos'ng Quo Nov. 30	Changes in Week	Date 1908 Ann. M't'g	Stock Outstanding	Dividend Basis	Dividend Last Declared	Dividend Date Last Div. Pay.
Allis-Chalmers	5¼	− ⅛	Sept. 6	19,820.000			
Allis-Chalmers pr	15	+ ⅛		16,150.000	7 cum	1¾ Q.	Feb., 1904
American Can	3⅜	+ ⅛	Feb. 1	41.233,300			
Am. Can pr	35	− ¼		41,233,300	7 cum	1¾ Q.	Oct , 1907
Am. Car and Fdy	28¾	+3	June 28	30,000,000		1 Q.	Oct., 1907
Am. Car and Fdy pr	82½	+1½		30,000,000	7 n. c.	1¾ Q.	Oct., 1907
American Loc	37	+2	Oct. 16	25,000 000	5	1¼ Q.	Nov.,1907
American Loc. pr	85	.....		25,000,000	7 cum	1¾ Q.	Oct., 1907
American Ship	36¼	.....	Oct. 10	7.600,000	4	3	Sept. 1907
American Ship pr	86	.....		7,900,000	7 n. c.	1¾ Q.	Oct., 1907
Am. Steel Foundries	5¼	− ¼	Oct. 2	15,810,000			
Am. Steel Foundries pr.	27½	+2½		17.240,000	6 cum	2½	Aug., 1904
Barney & Smith	65	.....	June 5	2,000,000	4	1 Q.	Sept.,1907
Barney & Smith pr	128½	.....		2,500 000	8 cum	2 Q.	Sept.,1907
Bethlehem Steel	9	+1	April 3	14.862,000			
Bethlehem Steel pr	23	−1		14,90[illegible],000	7 n. c.	¾ Q.	Feb., 1907
Cambria Steel	25½	+1¼	March 20	45,000,000*	6	1½ S. A.	Aug.,1907
Cambria Iron	40	.....		8,468.000*	4	2 S. A.	Apr.,1907
Chicago Pneumatic Tool	25	.....	Feb. 19	6,145 800	4	1 Q.	Oct , 1907
Colorado Fuel	17¼	+1⅛	Oct. 22	34.235,500		3½	Apr..1902
Crucible Steel	6	.....	Oct. 17	24,578.400			
Crucible Steel pr	55¾	.....		24,436.500	7 cum	1¾ Q.	Oct., 1907
Empire Steel	5	.....	Feb. 28	2,281,400			
Empire Steel pr	50	.....		2,500,000	6 cum	3 S. A.	July, 1906
Fay & Egan	100	.....	Feb. 20	1,000,000	6	1½ Q.	July, 1907
Fay & Egan pr	128½	.....		1,000,000	7 cum	1¾ Q.	Aug.,1907
General Electric	115	+6	May 15	65,167,400	8	2 Q.	Oct .,1907
Harbison-Walker	14½	.....	Jan. 22	18,000,000		½	Oct', 1907
Harbison-Walker pr	69½	.....		9.600,000	6 cum	1½ Q.	Oct., 1907
International Pump	12	+3¼	June 5	17,787,300		1	Apr.,1905
International Pump pr	57⅛	+4½		13,835,000	6 cum	1½ Q.	Aug.,1907
Lackawanna Steel	27	.....	March 14	34,971 400			
Lake Sup. Corp	5	+ ⅛	Oct. 3	40,000,000			
New York Air Brake	63¾	+4¼	June 21	10,000,000	8	2 Q.	Oct., 1907
Niles-Bement-Pond	130	.....	Feb. 7	5,000,000	6	1½ Q.	Dec., 1907
Niles-Bement-Pond pr	105	.....		2,000,000	6 cum	1½ Q.	Aug.,1907
Otis Elevator Co	20	.....	March 19	6,375 500		1½ S. A.	Oct., 1907
Otis Elevator Co. pr	65	.....		6,449.500	6 n. c.	1½ Q.	Oct,, 1907
Penn. Steel	50	.....	May 14	10,750.000			
Penn. Steel pr	10	.....		16,500.000	7 n. c.	3½ S. A.	Nov.,1907
Pittsburg Coal Co	8	+1	Feb. 10	28 297.800		.....	Nov.,1906
Pittsburg Coal pr	41⅞	+3⅜		27.246.800	7 c.	3½	Apr , 1905
Pressed Stl. Car	18⅝	+ ⅞	Feb. 21	12.500,000		3	Aug., 1904
Pressed Stl. Car pr	66¼	+ ¼		12.500.000	7 n. c.	1¾ Q.	Nov., 1907
Pullman	138	−1	Nov. 14	100,000 000	8	2 Q.	Nov., 1907
Railway Stl. Spring	25⅛	+2⅛	March 1	13 500,000	4	2 S. A.	Oct., 1907
Railway Stl. Spring pr	76	.....		13,500.000	7 cum	1¾ Q.	Sept.,1907
Rep. Iron & Steel	17	+3¾	Oct. 17	27.191,000		.....	
Rep. Iron & Steel pr	61	+3¾		20,416 900	7 cum	1¾ Q.	Oct., 1907
Sloss-Sheffield	34¼	+2¾	March 6	10,000,000	5	1¼ Q.	July, 1907
Sloss-Sheffield pr	80	.....		6 700,000	7 n. c.	1¾ Q.	Oct., 1907
Tenn. Coal & Iron	100¼	.....	May 7	29.500 000	4	1 Q.	Nov., 1907
U. S. Pipe & Fdy	18⅛	+ ⅜	June 27	12 500,000	4	1 Q.	Sept.,1907
U. S. Pipe & Fdy. pr	51	+1¼		12.500 000	7 n. c.	1¾ Q.	Sept.,1907
U. S. Steel	25⅜	+1⅜	April 16	508,302 500	2 n. c.	½ Q.	Sept.,1907
U. S. Steel pr	86⅛	+3⅞		360,281.100	7 cum	1¾ Q.	Nov., 1907
U. S. Steel 5's	83½	+4		463.798 000	5	5 A.	.....
Va. Iron, Coal & Coke	38½	+6⅜	Sept. 18	8,641,800		.....	.....
Westinghouse Elec	40	+5¼	June 27	24 998,700*	10	2½ Q.	Oct., 1907
Westinghouse Air Brake	133	.....	Oct. 2	11,000,000*		5 Q.	Oct., 1907

Par value of shares, $100, except those starred (*), $50.

Copper Stocks.

Boston.—Butte Coalition, closed 14⅞, net gain in week ⅞; Calumet & Arizona, closed 99, net gain 4; Calumet & Hecla Mining, closed 570, net gain 5; Green Cananea, closed 5¾, net gain ¼; North Butte Mining, closed 40½, net gain 2¾; Osceola Mining, closed 80, net gain 2; Quincy Mining, closed 79, net gain 7.

New York.—Amalgamated Copper, closed 51, net gain 2½.

Financial Notes.

The Republic Iron & Steel Co. has declared the regular quarterly dividend of 1¾ per cent on its preferred stock, payable Dec. 21. The preferred dividend for this quarter is usually paid on Jan. 1, but will be anticipated at this time.

The Pneumatic Scale Corporation, Quincy, Mass., is erecting a 1-story concrete engine house, 19 x 44 feet.

NEWS FROM MANY INDUSTRIES

New Buyers:—

The Joplin Stove Co., Joplin, Mo., has been incorporated by P. M. Bradley and L. M. Bradley, with a capital of $25,000.

The Standard Automobile Co., Ltd., of Toronto, has obtained a charter for the manufacture of automobiles and general machinery, with $40,000 capital.

The Ward-Parker Supply Co., St. Paul, Minn., capital $15,000, has been chartered by A. D. Ward, A. A. Parker and J. L. Enall to manufacture railway supplies.

The Canada Tool Co., Ltd., has been organized at Montreal by Wilber R. Hitchcock, Charles H. Cline and Robert S. Cline with a capital of $20,000.

The Akron Brass & Bronze Co., Akron, O., has filed articles of incorporation with a capital of $10,000. Those interested are: Jacob Alder, M. A. Holhut, Henry M. Ebman, N. O. Mather and C. R. Greece.

The Watson Bros. Iron Works, Albany, Ore., has been incorporated by J. T. Watson, J. E. Watson, F. W. Watson and C. A. Watson with a capital of $5,000. Work has already been commenced on a new plant at Albany.

Arthur W. Bice, Josephus Bice, Michael Owen and others of London, Ont., have been incorporated as the Bice Regulator Co., Ltd., for the manufacture of boiler equipment, etc., with a capital of $70,000.

The Samson Underframe Co., 820 Reaper block, Chicago, has been formed by William T. Underwood, George W. Manierre and Alvin T. McElroy with a capital of $10,000. The company will manufacture railway supplies.

Henry F. Blount, Henry F. Blount Jr., Walter E. Blount, William Davidson and Anthony Dietrich have organized the Blount Plow Works, Evansville, Ind., with a capital of $300,000.

With an authorized capital of $200,000, the Weyburn Mfg. Co., Rockford, Ill., has been organized to manufacture and sell agricultural implements. The incorporators are: R. S. Tuttle, C. E. Severn and G. V. Saxby.

The Pittsburg Portable Radiator Co., Pittsburg, has filed articles of incorporation with a capital of $225,000. Those interested are: Mortimer C. Miller, G. Terrence Miller, J. S. Humbird, C. C. Morrison and L. F. Cotter, all of the address given above.

The A. F. MacLaren Cheese Cutting Machine Co., Ltd., has been incorporated by W. H. Scott, George W. Hunt, Alexander F. MacLaren and others with $60,000 capital to manufacture cheese cutting and other machines at Ottawa, Que.

With an authorized capital of $10,000 the Planet Co., American Trust building, Chicago, has been organized to manufacture railway equipment. Frank Donnelly, Albert L. Letterman and Maurice Weigle are among those interested.

The W. H. Treadwell Co. of Illinois, 1608 Tribune building, Chicago, has filed articles of incorporation with a capital of $5,000 to operate foundries and machine shops. Those interested are: Alexander K. Hamilton, George Kolb and Charles P. Abbey.

The Humane Tug Post Co., First National Bank building, Chicago, has been incorporated to manufacture in iron, wood, etc. The capital stock of the company is $5,000, and the incorporators are: William Halte Thompson, Richard S. Folsom and Dwight Lawrence.

Articles of incorporation have been filed by the Avery Co., Peoria, Ill., to manufacture agricultural implements, machinery, etc. The capital stock of the company is $2,500,000, and the incorporators are: J. B. Bartholomew, F. P. Kinsey and L. G. Avery.

The Miser-Shuff Specialty Co., Watertown, N. Y., has been formed with a capital of $25,000 by A. E. Helmer, Evans Mills, N. Y., Charles E. Miser and J. H. Calkins, Watertown, N. Y. The company will operate a machine shop in connection with other manufacturing.

The Maryland Elevator Safety Lock Co., Baltimore, Md., capital $300,000, has been chartered by Milton Dashiell, 110 West Fayette street; J. Taylor Albert, 1317 North Calvert street, and W. G. Manchine, 218 East York street, Baltimore, to manufacture elevator safety locks.

Articles of incorporation have been filed by the Eagle Stamping Co., Buffalo, N. Y., to manufacture sheet metal, stamping, etc. The capital stock of the company is $20,000, and the incorporators are: Gottfried Adolphson, Charles Taw and Charles Fiester, all of 371 Seventh street, Buffalo.

The Strate-Fold Mfg. Co., New York, has been chartered to manufacture wire and metal goods by Frederick T. Adler, 256 Broadway, New York; Arthur T. Rutter, Mt. Vernon, N. Y., and Walter B. Maynard, Plainfield, N. J. The company is capitalized at $15,000.

Joseph A. Will, 237 Willis avenue; Christopher Klassen, 473 East 145th street, both of the Bronx, N. Y., and Hermann Meyer, 464 Rosedale avenue, Westchester, N. Y., have organized the Piano Metal Goods Mfg. Co., the Bronx, N. Y., with a capital of $9,000, to manufacture piano hardware and machine work.

The Joseph Honhorst Co., Cincinnati, has been organized with a capital of $30,000 to take over the sheet steel business of Joseph Honhorst & Co. The incorporators are Henry E. and Charles A. Honhorst, Elmer S. Lafe, Robert E. Hayden and Harry C. Busch.

The Iron & Wire Works, Brooklyn, capital $30,000, has been chartered by Philip Maurer, 3409 Avenue L, Flatbush, N. Y.; Valentine Schmith, 12 Eighth avenue; Edward A. Dubey, 958 Park place; Bernhard Diamond, 18 Bergen street, and George Maurer, 337 Adams street, all of Brooklyn. The company will manufacture iron, bronze, etc.

New Construction:—

The Fort Wayne Electric Co., Fort Wayne, Ind., has a foundry building in the course of erection.

The Crawfordsville Wire & Nail Co., Crawfordsville, Ind., is erecting a one-story brick warehouse, 60 x 202 feet.

The Superior Steel Co., Carnegie, Pa., has let the contract for the erection of a steel building 80 x 246 feet to adjoin its present plant.

The McGuire-Cummings Mfg. Co., Chicago, manufacturer of railway specialties, is preparing to erect a one-story office building 50 x 85 feet at 122 North Sangamon street, Chicago.

The Clarke Construction Co., 4 Sherman street, Chicago, has the general contract for the construction of a laboratory at Gary, Ind., for the Indiana Steel Co. The building will be 2-story, 51 x 63 feet, of reinforced concrete and brick construction.

Plans are being prepared by Architect Frederick Lindquist, 90 Washington street, Chicago, for tank and car shops to be built at Gary, Ind., for the Combined Liquid Tank & Freight Car Co., Chicago. There will be a main building, 1-story, 80 x 150 feet,

a paint shop 26 x 100 feet, dry kilns, etc.

The Cassens Mfg. Co., Edwardsville, Ill., recently incorporated, has leased a tract of land, 52 x 108 feet, in that city, and is now arranging a plant for the manufacture of a special eaves trough. A number of orders are on hand, and it is expected that operations will be commenced about Jan. 1. George Cassens is president.

The Marshall Car Wheel & Foundry Co., Marshall, Tex., has awarded the contract for the rebuilding of the portion of its plant recently destroyed by fire. The main buildings to be constructed will be 87 x 250 feet and 56 x 280 feet of brick and steel construction, absolutely fireproof. Several smaller buildings for warehouse and other purposes will be erected.

The Lake Shore & Eastern Railway Co., 1434 Commercial National Bank building, Chicago, has awarded the general contract for a power plant to be built at Gary, Ind., to the Hill Construction Co., 171 La Salle street. The plant will comprise a 1-story boiler house 35 x 60 feet, and a 2-story engine house 28 x 56 feet of fireproof steel construction with brick exterior.

The Southern Car & Mfg. Co. is arranging to begin work upon the construction of a car works at Chattanooga, Tenn. Plans are now being prepared by Adams & Alsup, Chattanooga, for the buildings which will include a machine shop 100 x 170 feet. All the structures will be absolutely fireproof and will be located upon a tract of about two acres of land. James M. Wiggs, Beaumont, Tex., is president.

General Industrial Notes:—

The Freeport Mfg. Co., Freeport, Ill., has certified to a change of name to the Stover Gas Machine Mfg. Co.

The Vulcan Iron Works, Chicago, has removed to its new plant at 28 North Irving avenue, near Fulton street, in that city.

The American Automatic Switch Co., Salisbury, N. C., has organized by electing Harold Shemwell, of Lexington, N. C., president; N. B. McCanless, vice president, and P. H. Thompson, secretary-treasurer.

The Milwaukee Stamping Co., Milwaukee, has increased its capital stock from $25,000 to $100,000 and the number of its directors from four to five. August Petri is president, and Charles Petri, secretary.

The American Blower Co., Detroit, reports that its increase of capital stock has been made, not so much to apply to prospective extensions to its plant as to cover large additions which have been made during the past two years. At present the company has no buildings under way.

The plant of the Frankfort Brass Works Co., Frankfort, Ind., has been sold at receiver's sale to I. N. Perlstine, of Chicago, for the consideration of $9,000 and the assumption of a mortgage of $10,600. Mr. Perlstine is now endeavoring to obtain financial support in Frankfort, preparatory to again operating the plant.

The Rider-Lewis Motor Car Co., Muncie, Ind., has practically completed the purchase of equipment for its new plant, but would like to be placed on manufacturers' mailing lists. The company is bringing out a light 6-cylinder touring car and roadster.

The Detroit Twist Drill Co., Detroit, has increased its capital stock from $66,000 to $150,000 to take care of the purchase of a site and the erection of a plant at 634-646 Fort street, west. The company moved into its new quarters Aug. 1.

Jordan Bros., 74 Beekman street, New York city, recently incorporated, will conduct the electrical machinists' business of the firm of Jordan Bros., which has been the buying and selling, repairing and installing of electrical machinery, and also the manufacture of the Jordan commutator truing device and the Jordan splice protector.

The Webb & Hildreth Mfg. Co., Gloversville, N. Y., succeeds the firm of Webb & Hildreth, manufacturing machinists. At present the company is manufacturing glove finishing machinery, but expects to manufacture several metal specialties among which is a newly patented automatic wrench to be used on a pipe or nut. Application for patents for other articles has also been made.

The Pennsylvania Brake Beam Co., Easton, Pa., has acquired a tract of 10 acres of land upon which several buildings are located at Danville, Pa., and is about to remove its plant to that city. The main rolling mill and brake beam building is 220 x 470 feet, which is equipped with 1,500-horsepower boilers, a 1,000-horsepower engine, and a 24-inch three-high roll train, all of which has been installed.

The New England Iron Works Co., Boston, manufacturer of boilers, stacks, and general iron work, recently incorporated, states that it has been formed to take over and carry on the business of the Cunningham Iron Co., which has discontinued operations and will conduct the business in the same plant at Summer, B, and Fargo streets, Boston, and along the same lines practiced by the former company. Peter B. Gaudet is president, and Charles F. Koopman Jr., treasurer and general manager.

H. A. Lanman, president of the Columbus Belt Works, Columbus, O., says that, while orders are not as plentiful this fall as they were this time last year, collections have been very good, and the prospects are very bright for a good year in 1908.

The Wales Foundry & Mfg. Co., New Brunswick, N. J., organized six months ago to build a foundry at that point, has announced that it has abandoned its plans and will return stock subscriptions. In a circular letter sent to the subscribers, Secretary A. C. Streitwolf Jr. says that it is the belief of the directors that the present state of the foundry business and of the country's finances, forbids the carrying out of the original plans.

The Michigan Crucible Steel Castings Co., Detroit, Mich., is again in operation after the recent disastrous fire at its plant. The damage to the core-making room, melting and furnace room was large, and practically all of the roof of the plant was burned off. The machinery, however, was only slightly damaged, and the office escaped intact. No new buildings will be erected, but a new roof is now being put on the furnace room. The company is now melting and molding in a small way, but expects to have five four-pot furnaces ready for use in a week or ten days.

Trade Notes:—

The Western Wheeled Scraper Co. and the Davenport Locomotive Co. have opened offices at 107 Third avenue north, Minneapolis.

The Allis-Chalmers Co. has obtained the contract for machinery in an 800-barrels-a-day flour mill to be erected for the Meiji Flour Mills, at Yokohama, Japan. There will be 10 carloads of equipment.

The Allis-Chalmers Co. has engaged for its office in St. Louis a new suite of rooms located at 1302-1304 Third National Bank building, where the company's district manager, F. L. Bunton, and the salesmen of his staff will be located after Jan. 1.

The Southwestern Bridge Co., Joplin, Mo., has been awarded the contract to build a bridge across the Neosho river near Chanute. The crossing consists of one 200-foot span, one 70-foot span and two 30-foot steel approaches, the roadway being 20 feet. Work will be completed about June 1, 1908.

The Expanded Metal & Corrugated Bar Co., St. Louis, is furnishing the reinforcement required for the construction of three circular reservoirs, 100 meters in diameter, for the Potable Water Commission, city of Mexico. An order for 2,600 tons of corrugated bars has been placed with the company.

The Kilbourne & Jacobs Mfg. Co., Columbus, O., has shipped for export, during the last five weeks, 65 carloads of freight, going to Cuba, Mexico, Peru, Colombia, Chile and Germany, and it has further orders booked for export to Chile, England, Cuba, Porto Rico and Mexico.

Fires:—

The plant of the Lennox Furnace Co., Marshalltown, Ia., suffered a loss of about $3,000 by fire Nov. 27.

Fire in the machine shop and store room of the Meyers Machine Co., Petersburg, Ind., caused damage estimated at $6,000 Nov. 23.

The Superior Foundry Co., Cleveland, sustained a small loss by fire Nov. 26. Prompt action of employes prevented more serious results.

The plant of the Port Huron Engine & Thresher Co., Port Huron, Mich., was damaged to the extent of $6,000 by fire Nov. 15.

TRADE PUBLICATIONS.

Steels for Automobiles.—The Carpenter Steel Co., Reading, Pa. Catalog. 24 pages. 6 x 9 inches. Discusses the various alloy-steels manufactured by this company. The introductory pages of this catalog deal with the great development of special steels and their application to the automobile industry, and state that this company has made a special study of alloy-steels and the methods of handling them. All kinds and types of these various steels are illustrated in this booklet, including crucible alloy-steels, chrome-nickel auto-steel. Tensile tests are given of chrome-nickel auto-steel, dynamo auto-steel, dynamic auto-steel, nickel steels, auto-valve steel, special nickel steel, standard nickel steel, C. H. nickel steel, silico-manganese steels, crucible auto-steel, special auto-steel, carbon steels, and weldable auto-steel. Following this is a summary of tests, including compression, bending and drop tests of each type of steel, and in conclusion the catalog presents a few pages on the subject of special automobile steels and their successful application in automobiles.

Electric Appliances.—The General Electric Co., Schenectady, is distributing bulletins 4542 and 4545, dealing with the subjects of concentric and inverted light diffusers and electric motors, respectively. Bulletin No. 4542 introduces the concentric light diffuser, describes the device, illustrates many of its applications, gives a partial list of its many installations in department stores, factories, machine shops, armories, public halls, colleges, etc., and includes some important data on the subject of arc lighting. The advantages of this light diffuser are also enumerated, such as its white, even and well distributed light, its restfulness to the eyes, etc. Bulletin No. 4545 illustrates various sizes of type IS form KG single-phase motors, describes the details of their construction and operation, shows forms of starting boxes and gives a large amount of general information. The motors are wound for standard voltages and frequencies.

Engineering Specialties.—The Wm. Powell Co., Cincinnati. 281 pages. Catalog and Price List No. 9. Second edition. The first pages of this booklet contain views of the various departments, including the draughting department, the tool department, testing department, turret lathe departments, etc., and some of the offices and officers. This is followed by descriptions, illustrations and price lists of the many different kinds of valves manufactured by the company, including the Powell "white star" globe valves, the "model star" globe valves, regrinding hydraulic valves, the patent "giant" lever throttle valves, etc. The catalog then takes up the subject of locomotive lubricators, oiling devices of different kinds, water gages, brass steam fittings. The catalog concludes with a supplement of valuable tables and useful information to engineers and mechanics.

Power Specialties.—The Williams Gauge Co., Pittsburg. Bulletin. 4 x 9 inches. Special attention is given in this bulletin to the Williams safety feed water regulator. The other articles manufactured by this company are the Williams steam pump governor, steam operated trap, rotating regrinding gage cocks and automatic water gage.

High-Speed Steel and Drills.—The Carpenter Steel Co., Reading, Pa., in a small 40-page catalog presents practical tests made with Zenith high-speed steel in some of the manufacturing and railroad shops. The tests are listed according to the kind of material on which they were made and are of lathes, planers, boring mills, milling-cutters, boring-lathes, tire-lathes, etc. They were made on cast iron, malleable iron, steel castings, machinery steel forgings, nickel-steel forgings, annealed tool-steel, etc. Some testimonials and comparative records showing life of pipe cutters are given and a few pages are devoted to valuable hints for working Zenith high-speed steel.

Die Heads.—The Geometric Tool Co., New Haven, Conn., is distributing a small catalog on style D self-opening and adjustable screw cutting die heads designed for use on the turret of hand and automatic screw machines, as well as on other screw cutting machines in place of solid dies.

Mining and Metallurgical Machinery.—The Traylor Engineering Co., 2 Rector street, New York city, in a 23-page catalog describes and illustrates the Traylor concentrating table. Numerous illustrations of its various parts, including the sub-frame, top riffles, etc., are given, with descriptions of its construction, head motion and adjustments and directions for its installment. The centri-pact screen, heavy duty rolls, rock crushers, Chilian mill, etc., are also illustrated and described.

Wire Brushes.—The American Wire Brush Co., New York, has issued an attractive catalog descriptive of its "Minerva" steel wire brushes, emphasis being laid on their adaptability for the cleaning of castings, forgings, files, machine tools, boiler tubes, etc. The casting brushes are made in both flat and circular shapes. Flexibility is secured by fastening the wires loosely yet securely in the back of the brush, instead of embedding them immovably in their sockets. The booklet contains 16 pages, 6 x 9 inches, separate sheets describing a circular brush connected with a portable motor for attachment to an ordinary lamp socket.

Concentrating and Briquetting.—The American Grondal Kjellin Co., 45 Wall street, New York, has brought out a sixteen page booklet descriptive of its methods of concentrating and briquetting iron ores. Tabulated results of various installations are given, that at Cornwall, the only one yet in operation in America, bringing the iron content up from about 30 per cent in the crude ore to about 70 per cent in the concentrate and briquette, at the same time practically eliminating the sulphur and phosphorus. Reports are given on a number of foreign installations, photographs of which embellish the bulletin. 7 x 10 inches.